The
Electrical Review

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Those Infra-red Rays

A REPORT has appeared in a lay contemporary of a statement by Professor Sir Leonard Hill regarding the cause of "stuffiness" in a heated room. It is possible that the headlines given to this Press account may suggest to the general public that the electric fire may produce unhealthy conditions, which those of us who have enjoyed electric heating for many years know do not obtain in practice.

Sir Leonard's investigations have led him to the conclusion that stuffiness is not due to unsuitable conditions of humidity, ionisation of the air, the formation of carbon dioxide, or roasted dust particles, to one or other of which it has often been attributed in the past.

He accounts for the discomfort experienced by the action of infra-red rays in producing congestion of the nasal sinuses. These infra-red rays are radiated from dark surfaces, such as anthracite or coke stoves; the dull red rays from electric fires have, he finds, a similar effect on some people under certain conditions. The proximate cause is a nervous reflex due to such rays falling upon the naked surface of the skin, when directly facing the radiator.

The antidotes are simple. They are the provision of adequate ventilation, the cooling effects of an electric fan, the light from an ordinary electric lamp on the exposed skin, or the keeping of the feet warm at an electric radiator.

It is generally agreed that where an electric fire is used special care should be taken to arrange good ventilation, which not only ensures dilution of bacteria, but also keeps the air in motion.

Some research that we undertook several years ago indicated the major importance of avoiding still air, in which the skin is unable to play its proper part in assisting respiration. Where it is impracticable to obtain a constantly moving volume of air from outside, the merits of the electric fan with any form of heating cannot be over-estimated.

The feeling of discomfort due to infra-red radiation has probably a bearing on the so-called "psychological effect" of luminous heating. Nevertheless, when the external air temperature is low, some degree of convected heat is found desirable by most people, and this will be supplied concurrently with infra-red rays.

We probably cannot have a heating system that is perfect in all respects. It is a question of what is the best method on balance. Electricity provides a means, more readily than anything else does, of obtaining the most desirable conditions. But are we content to allow the matter to rest there?

At present electricity is used mainly for intermittent heating, but this is a phase that is rapidly passing. With lessening tariffs and improving technique we expect to see very soon a considerably greater amount of electricity sold for long-hour heating. It may be said that the present criticism of the electric fire is academic only. That may be so, but the electrical industry cannot afford to leave it at that. It must be ready to meet the demand that is coming with apparatus that offers not only the cleanest and most convenient system of heating, but one that is proof against criticism on any grounds whatever.

Association Reports

THE electrical industry and the electrical profession have many organisations. It would be interesting to know how many of them have done all that should have been done during the past troublesome twelve months for the particular sectional interests that come under their care. Sometimes annual reports form very dry reading matter, and require an explanatory oration to put life into facts and figures and turn the records of officials into living documents. One can well imagine that the work is exceptionally difficult in such periods as industry has lately experienced. Yet we suppose it is not unnatural for somebody to ask whether the actual results obtained in a year of stress justify existence. If we examine the report of the Council of the British Electrical and Allied Manufacturers' Association, which came before the annual meeting in London yesterday and is sum-

marised in this issue, two matters stand out somewhat prominently among the year's achievements. First, the Buenos Aires Exhibition and the consequent appointment of a permanent representative of the British electrical industry in the Argentine; second, the provision of trade information to the National Government by the B.E.A.M.A. when it was decided to impose special duties upon abnormal electrical imports in certain classes. Neither of these matters could have been satisfactorily arranged in the absence of a representative organisation to assist manufacturers to adopt a united overseas policy, or to afford reliable trade information to the Government. It is also to a central body that the latter will look for a certain measure of assistance in fixing tariff arrangements.

Future Business

MANY other things, of the usual varied character, have kept the staff busy, but these hardly call for comment. Interest centres more particularly around the general review with which the report opens. Here we learn once more that the practical completion of the national grid makes it imperatively necessary for us to find new markets by a more rapid rate of progress of the domestic load and by the development of overseas trade. While generating plant, both for home and export, showed a progressive decline, and turbines and turbo-alternators fared badly, switchgear orders held up well until the close of the year. There was a small increase in converting plant business. The manufacturers of smaller apparatus fared best of all, and some sections of electrical employment showed improvement owing to the progress made in domestic electrification. In this department and in industrial works equipment there is plenty of scope. The Council anticipates that 1932 will be a year of gradually improving trade, and already sees signs that the purchasing power of primary producing countries is rising. Though it will be some time before the full effect of tariff legislation can be felt, there is a new spirit of optimism abroad anticipating that effect. Restored confidence will greatly help to bring trade revival.

Generation at 33 kV

CONSIDERABLE savings in capital expenditure and operation costs are to be expected from generation at the voltage of transmission. This expectation has, we understand, been confirmed by experience at Brimsdown. The credit of the initial development of 33-kV alternators belongs easily to Great Britain, as, apart from the two Brimsdown sets and one at Langebrugge built by a Continental firm (but which, as far as we are aware, is not yet running), no other machines have yet been constructed for this voltage. The South African Electricity Commission (as reported in our "Contract Information" Section) has now ordered a 33-kV 25,000-kVA alternator for its Salt River station at Cape Town. Presumably this will be of similar design to the Brimsdown machines, in which the electrical stress on the stator windings is distributed by the use of triple concentric conductors, the three layers of which are connected in series on each phase.

A Distinct Improvement

THE returns of the Electricity Commissioners for last month show a most welcome increase over the figures for kWh generated in February, 1931. Allowing for the additional day in the month, the rate of growth—12½ per cent.—is not so very far short of the increment to which we had until recently become accustomed. It brings the total kWh generated this year to 6.5 per cent. more than it was at the end of February, 1931. Contributory to this result was the 88,910 h.p. transferred during 1931 from private plant to the mains of twelve of our power companies. More than half of the amount (46,886 h.p.) is a clear gain to electricity, as it represents a change from steam or internal-combustion engines. The balance is due to the closing down of privately owned electrical plant, and indicates the trend towards reliance on a public supply under economic pressure.

Electrical Publicity

MR. FRANK HODGES spoke comforting words to the Birmingham Electric Club regarding the progress made electrically in this country in relation to others. This should not lead to complacency, as we had a good deal of leeway to make up. Neither need we accept any other standard of attainment than that of our own most progressive undertakings to bring about the use of electricity at a reasonable price for everybody for every purpose. Our continued advance, we believe, has been due largely to the growing realisation of the value of publicity and propaganda, and more particularly to the work of E.D.A. In our Correspondence columns to-day Col. Vignoles clears up the obscurity surrounding the curtailment of the activities of the Central Society for Electrical Development in the United States, and points out that the N.E.L.A., which performs many of the functions carried out here by E.D.A., is launching a new campaign of co-operative publicity. The last paragraph of his letter concisely sums up the needs of the situation as we see them.

County Progress

NOTHING hinders the progress of the County of London Electric Supply Company. The 44,000 consumers added during the past year brought up the total to 246,000, while 62 million additional units were sold. As will be remembered, some reductions in supply tariffs were made. The company's development scheme for the County of Essex is making headway and supply is available in fifty districts. The two new 75,000-kW sets at the Barking power station will be undergoing their preliminary trials in the autumn. Barking and Wandsworth power stations are not yet operating as "selected" stations, as the Central Board has not begun to function as a generating authority in South-East England, but temporary arrangements have been made for the company to give supplies to the Board. It is impossible to imagine a limit to the company's scope for development.

American Farms

IN spite of trade depression, rural electrification in the United States showed a gain of nearly 8 per cent. last year, during which nearly 50,000 farms were connected to the public mains, bringing the total so supplied up to about 700,000. Nevertheless, this advance, and also some progress in domestic electrification, has not been enough to compensate for the severe falling-off in output in the central industrial regions, which was nearly 12 per cent. less during the last week of February than in the corresponding period of 1931. For the first two months of this year the overall decline in consumption in the U.S.A. has been 6.75 per cent., a striking indication of the difficult times which the industry is passing through over there.

The Varley Centenary

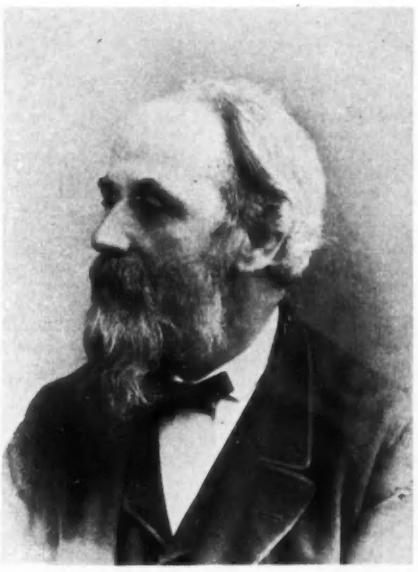
NEXT Tuesday is the centenary of the birth of one of the outstanding pioneers in the application of electrical science. We refer to Samuel Alfred Varley, the inventor of the first self-exciting and the first compound-wound dynamos. Our present issue includes an article outlining his principal achievements, the importance of which was long ago fully recognised by us, as our files of the last century show. Yet fame may be said to have passed him by, and he lived most of his life in conditions bordering on poverty. Varley was always slow to assert his claims to priority, and was deficient to a degree, remarkable in even a man of genius, in the commercial acumen that would have enabled him to reap the reward of his labours. We trust the arrangements made by the I.E.E. to commemorate Varley's life and work next month will be supported in a manner proportionate to the benefit we have all received from his inventions.

The Inventor of the Dynamo

Samuel Varley, born March 22nd, 1832

FEW men of outstanding scientific achievement can have received so little recognition, material or otherwise, of their work as has Samuel Alfred Varley. This lack of appreciation of a great English inventor is all the more remarkable in that his principal invention was that of the self-exciting dynamo, in which his claim for priority is incontrovertible.

Far-sighted as Varley was in the applications of science, he lacked that business instinct which would have enabled him not only to establish his right to be regarded as first in the field, but also to reap the large pecuniary rewards which might have been his.



Samuel Alfred Varley, "The Father of the Dynamo." Born March 22nd, 1832. Died August 4th, 1921

Early Scientific Tendencies

Varley was born on March 22nd, 1832, in London, and was educated at St. Saviour's Grammar School, Southwark. He was the son of Cornelius Varley, who was connected by marriage with Michael Faraday, and who was well known as an artist, optician, and microscopist. Samuel Varley thus came early under the influence of Faraday, whose lectures at the Royal Institution he attended.

On leaving school at the age of 14 he devoted his time to chemical and electrical research until, in 1852, he entered the Manchester workshops of the Electric and International Telegraph Co., and two years later took charge of the engineering work of the Liverpool telegraph district. At this time he devised what was probably the first electric chronograph for measuring time intervals in connection with the long-distance time-ball signals between Greenwich and Liverpool.

Telegraphy in Warfare

When war broke out in the Crimea his reputation as a telegraph engineer led to his appointment as civilian officer in charge of the first field telegraph used in warfare.

His war duties concluded, Varley investigated the principles of submarine telegraphy. His views, at variance with prevailing theories, were accepted as the result of a discussion at the Institution of Civil Engineers in 1858; Faraday himself admitted the fallacy of his previously held opinions.

Samuel Varley was then associated with his elder brother, Cromwell, in laying the first successful Atlantic cable, and the two brothers worked out the principles of electric condensers with reference to submarine telegraphy.

The First Dynamo

In 1859 he rejoined the Electric and International Telegraph Co. and directed his attention to the design of a dynamo which should do for dynamic electricity what his brother's "symmetrical influence" machine was doing for static electricity.

At this point he was called upon to manage a family business, and it was not until September, 1866, that he was able to complete his self-exciting dynamo, the first machine to be built with soft-iron magnets, and now to be seen in the South Kensington Museum, among other historical apparatus.

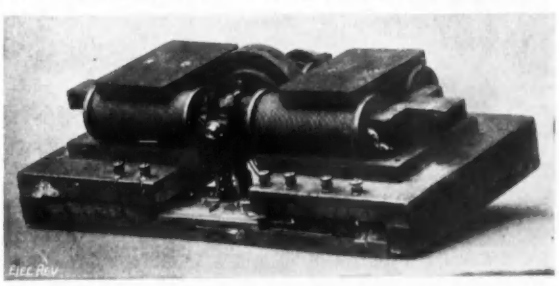
Pressure of other work prevented his publishing his claim immediately in the form of a paper before the British Association, as he had intended, or before the Royal Society, as he was urged to do. Most unfortunately, also, the patent specification was not lodged until December. The missing of these opportunities caused his claims for priority to be obscured by those of Wheatstone and of Siemens in the following year, whose machines, however, were not designed to be self-exciting, as Varley's machine certainly was.

Nevertheless, at the International Inventions Exhibition of 1885 he was awarded the gold medal of the Exhibition for "devising the first self-exciting dynamo machine," thus securing some recognition.

Another notable invention in 1866 was an improved needle telegraph, which was protected by a lightning bridge embodying the principle afterwards perfected and applied by Hughes to the microphone. A third achievement in the same year was the development of a system of electrical signalling between railway passengers, the guard, and the driver, which was introduced upon several main-lines.

The Compound-wound Machine

Telegraphy absorbed most of Varley's time until 1876, when, after much experimental work, he evolved his compound-wound dynamo. This was born before its time—before the incandescent lamp era—and the patents were allowed to lapse. A few years later, in a series of lawsuits, he was able both to substantiate his claim as an inventor and to prevent the payment of unjustifiable royalties to manufacturers.



The original self-exciting dynamo constructed in August, 1866

We have implied above that the great value of Varley's work was not realised; that requires some qualification.

Testimonies of Scientists

That the greatest among the electrical engineers and scientists of the 'nineties did recognise his genius is apparent from the record, in the pages of the ELECTRICAL REVIEW in 1892, of the activities of the committee (including some of the most illustrious names of the time) which was appointed to promote a testimonial in his honour. It was as a result of this committee's efforts that he was granted a Civil List pension.

In our issue of September 9th of the same year we published also an appreciative account of his scientific life up to that time.

Varley lived until 1921, but he was a man of disappointed ambitions. He was a very close friend of the ELECTRICAL REVIEW and a frequent and most-welcome visitor at these offices. His last appearances in public took place when some of the present members of our staff fetched him by cab—because of his increasing infirmity—to several of a series of ELECTRICAL REVIEW staff concerts held at Anderton's Hotel.

The Institution of Electrical Engineers has arranged to pay its tribute to Varley's memory on May 5th, when a short discourse will be delivered by Lieut.-Col. A. G. Lee, O.B.E., M.C.

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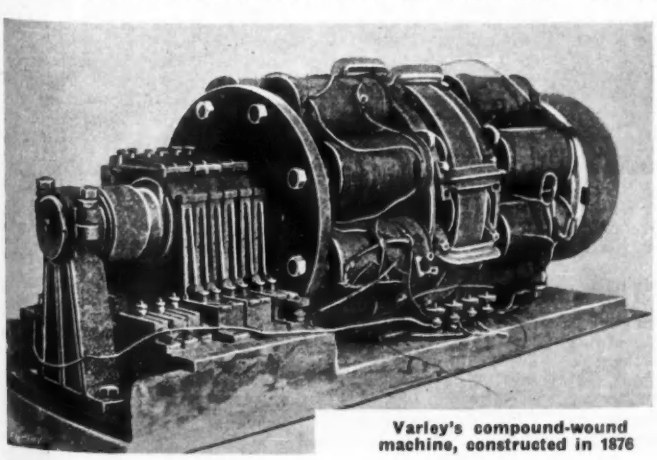


Varley's compound-wound machine, constructed in 1876

Progress at Battersea

First Section of the London Power Co.'s new station well advanced

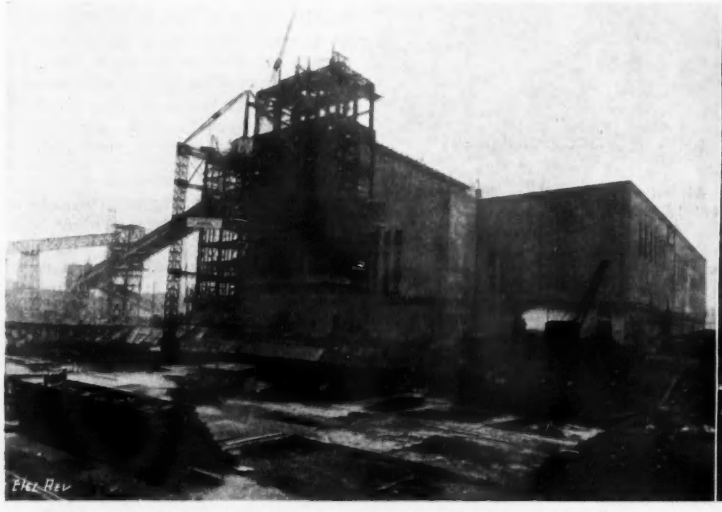
MODERN power-station equipment is becoming so increasingly "closed in" that it is nowadays difficult, if not impossible, to gain an adequate appreciation of a large installation after it is completed. It is necessary to make an inspection during the constructional stages.

Further, actual erection nowadays involves problems, many local in character, responsible for considerable engineering advances, while the necessarily lengthy construction periods result in work in hand and general technical advance having a considerable bearing on each other.

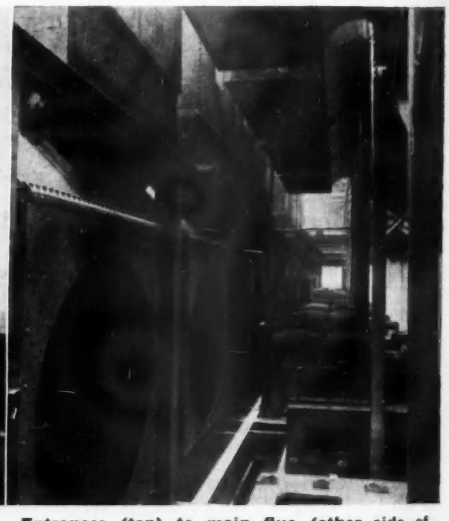
It is because of these facts that we welcome the opportunity, by the courtesy of the London Power Co., Ltd., to publish the following notes upon the progress which has been made in the construction of the new Battersea power station. No pretence is made to describe the scheme fully.

The buildings for the first half of the station are nearing completion, but, generally, plant for only one-third of the whole works is being installed. The boiler, turbine and switch houses are arranged in that order longitudinally side by side, with a central boiler control aisle, which will be common to both sections of the station, adjacent to the boiler house. The second half of the station will involve a duplication of the buildings in the reverse order.

A jetty, coal-handling plant and a coal store, now nearing completion, will serve the whole station. Normally coal will be received at the jetty and conveyed by a double-belt system, each belt being 30 in. wide, *via* the tower in the background of illustration (2) on the opposite page and the central tower from which it will branch off to the left to the boiler house. The wagon tippler is intended mainly for emergency purposes and will be served by a single 30-in. belt.



Battersea Power Station from riverside, showing frame for chimney tower



Entrances (top) to main flue (other side of wall); grit extractor housings right; connecting ducts not in position

The Boiler Plant

Sufficient advance has been made with the erection of the six Babcock & Wilcox, 330,000-lb. water-tube boilers to enable the boiler house to be closed in at an early date. The steam conditions will be 625 lb. per sq. in. and 875 deg. F. The boilers are being equipped with Bailey walls and Taylor retort stokers.

Cranks at the front of the boiler operate rams which push the coal down the inclined grate, the rams working between the banks of plates indicated. Clinker falls down the opening shown at the right of illustration (6) and is crushed between the toothed rollers before dropping into the ash sluice. The front Bailey wall is suspended on the spring supports shown at the top of the beam above the stoker ram gear.

Ashes are to be removed by a water-sluice system to two pits at the south end of the buildings, from which they will be grabbed and loaded into telphers for final removal by rail or road. The pits have been completed and will serve the whole station.

The economiser unit is situated above each boiler. Referring to illustration (7), the flue gases will pass up the braced ducting on the left, turn at the top and come down the centre compartment outside the feed-water tubes, the ends of which are shown. At the bottom the gases will turn again up into the right-hand closed compartment or air heater through the enclosed tubes.

After passing through the grit extractors shown on this page, the gases will be conveyed through ducts and fans, not yet in position, to the curved ducting at the top right and thence to the main flue at the other side of the wall on the right.

Gases are to be subjected to the company's special process for the elimination of all sulphur oxides. The main flue runs the whole length of the boiler house, and there is being constructed at each end a chimney tower with three vertical compartments. During their passage along the flue, down the centre compartment of the tower and up the side compartments, the flue gases will be considerably cooled by the time they reach the base of the chimney, but they will be warmed again to a certain extent by the injection of warm air at the chimney base, the air being warmed by its passage along the bottom of the flue. The chimney proper will be erected on each 180-ft. tower, the total height being 325 ft.

An outstanding feature of each boiler is the solid forged steam drum, made by John Brown & Co., Ltd., 46 ft. long, 4 ft. internal diameter, 40 tons, with a shell 2¾ in. thick. The drum is suspended on solid-steel stirrups, 5 in. sq., from girders above by lock-nuts. Erection of these drums, which are longer than the distance between the columns, was accomplished by tilting the drum to about 45 deg. before lifting.

In the Turbine Room

The turbine room is being equipped with two 80,000-kVA B.T.-H.-Metropolitan-Vickers turbo-alternator sets, each comprising a three-cylinder turbine, a main 11,000-V alternator and a 6,250-kVA, 3,300-V house alternator. The first illustration shows the near set with the intermediate steam rotor and the far set with the alternator rotor in position. The condensers, Richardsons, Westgarth & Co., Ltd., for the two sets are almost completed, as are the screening and outlet chambers and the circulating-water culverts for the first half of the station. On each side of the turbine house there is an annexe, one burrowed from the switch room to house the auxiliary switchgear, and one similarly burrowed from the boiler house to accommodate the motor- and turbine-driven feed pumps, air compressors, &c.

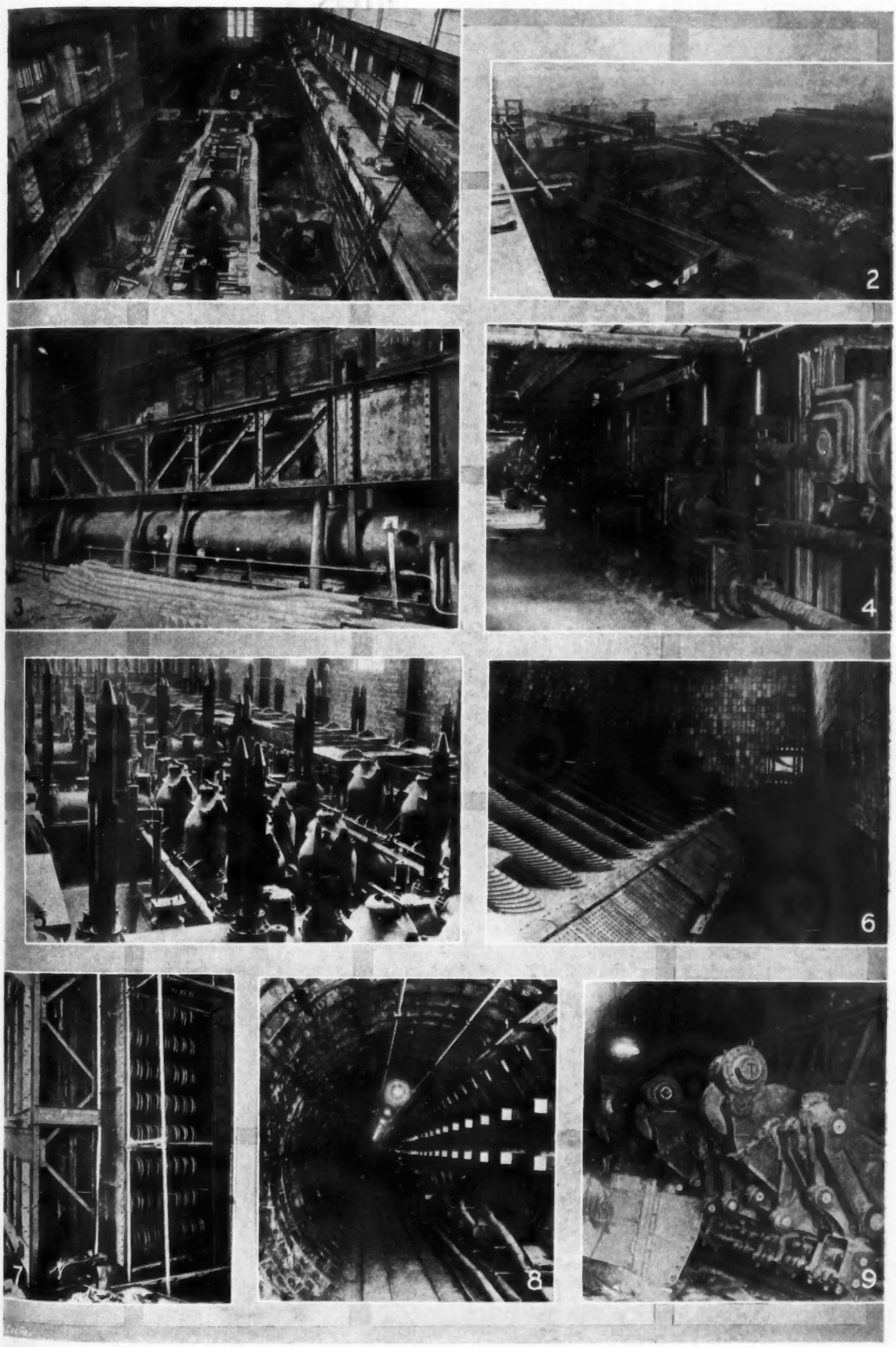
All main switching will be carried out at 66,000 V, and the step-up transformers (Ferranti), each weighing 120 tons, are believed to be the largest so far made in this country. Each unit is housed in a separate cell at the ground level, and has a capacity of 80,000 kVA, three-phase.

The first third of the switchgear (M.V.) for the first switch house approaches completion. The control room for the complete station is being constructed with bay windows projecting into the turbine house.

Interconnecting cables enter at the south end by a concrete cable tunnel, and at the north end an 8 ft. 3 in. tunnel which, at the centre line of the complete station, where a similar tunnel from the second half of the station will meet it, diverges into a 10-ft. tunnel under the river, finishing in a concrete chamber 20 ft. below ground on the embankment side of the river. From this, cables diverge into trenches. The river tunnel is at present equipped with cable racks on one side only for the present half of the station.

High-pressure Boilers for Moscow

The Moscow generating station is to contain two Loeffler boilers with a normal capacity of 285,000 lb. per hour. The steam pressure is to be 1,900 lb. and the total temperature 932 deg. F. Local coal of low calorific value will be used. It will be pulverised and mixed with air at 485 deg. F. The double furnace chamber is of 21,000 cub. ft. capacity; the radiant superheater has a superficial area of 3,120 sq. ft. Re-superheaters of the convector type will raise the temperature from 735 to 932 deg. F. Reheaters, economisers, and air reheaters will also be installed.



The Progress of the New Battersea Power Station

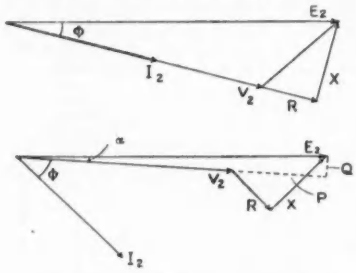
1. Turbine room from crane, two 80,000-kVA turbo-alternator sets; 2. Coal-handling plant from boiler-house roof, railway-wagon tippler right; 3. Solid-forging boiler steam drum—46 ft. long, 2¾-in. walls, 40 tons; 4. Section of main bus-bar system; 5. Main oil circuit-breaker floor, showing isolator units and breaker guides; 6. Looking into the combustion chamber of a 330,000-lb. boiler with retort stokers; 7. Base of economiser equipment—feed-water heater, centre; air heater, right; 8. In cable tunnel under river—cable cross-overs near camera; 9. Boiler front from firing floor.

Instrument Transformers. By A. Hobson, B.Sc.(Tech.)

Errors introduced as an effect of burden power factor

THE best practicable method of calibrating meters is with the current transformers in circuit. If this is inconvenient, the total errors due to both current and voltage transformers may be estimafed and the meters calibrated at two line power factors, say unity and 0.5 lagging, it being assumed that the meter will run accurately at any intermediate power factor.

For example, suppose that the errors of a voltage transformer, with its burden connected, are +0.5 per cent. ratio and +20 minutes phase angle, a positive ratio error indicating that the secondary voltage is high and a positive phase error that the secondary voltage leads the primary. Thus the applied voltage is 0.5 per cent. higher (proportionally) and 20 minutes in advance of the voltage it represents. The ratio error causes the meter to run 0.5 per cent. fast, independently of line-load conditions, but the effect of the phase angle varies with the load power factor. At unity power factor this effect is negligible, but at 0.5 p.f. a variation of 20 minutes causes the power factor to vary by 1 per cent., and since in this case the phase angle tends to increase the angle of lag between voltage and current, the power factor, and consequently the meter speed, will be reduced by 1 per cent.



Non-inductive load and secondary voltage (top)
Inductive load and secondary voltage (bottom)

Thus, at unity power factor the total effect of the transformer is due to the ratio error (i.e., the meter runs 0.5 per cent. fast, and at 0.5 power factor it runs 0.5 per cent. slow due to the combined effects of the ratio and phase angle errors) and the meter is calibrated accordingly.

The present practice in this country is to read off the errors from the manufacturer's curves, but this is incorrect, since it assumes that the transformer burden has a power factor of unity, whereas it is about 0.3.

Voltage Transformers

Fortunately, it is not necessary to test voltage transformers at their working power factor, since, given the characteristics of a transformer on non-inductive load, it is easy to deduce the corresponding performance at any power factor.

In the typical characteristic curve of a voltage transformer tested on non-induction burden shown in the first figure, at no load the ratio and phase-angle errors are +0.8 per cent. and +25 minutes, respectively, falling to −0.8 per cent. and +15 minutes at 100 VA. The performance curves of normal voltage transformers are straight lines; varying the secondary power factor alters the slope of these lines, the points corresponding to the no-load errors remaining stationary. Thus we are only concerned with the difference between the no-load and full-load errors, i.e., the regulation of the transformer as regards both ratio and phase; further, since the characteristics are straight lines with one end fixed, only one point on each need be calculated to obtain the complete characteristic.

In the figure showing the vectorial effect of non-inductive load on the secondary voltage, the current I_2 is in phase with V_2. R and X are the voltage drops due to the total resistance and leakage reactance of the transformer, and E_2 is the no-load secondary voltage. As, in practice, R and X are small compared with V_2 and E_2, R is the voltage regulation, i.e., the drop in voltage due to the load. Similarly, X is a measure of the angle α, the change of phase angle from no-load to full-load, i.e., the phase regulation. In the case of inductive burden I_2 lags by ϕ behind V_2; R and X, being respectively in phase and in quadrature with I_2, change position relatively to V_2, and a change in both voltage and phase regulation results.

The new values are represented in the diagram by P and Q; $P=R\cos\phi+X\sin\phi$, and $Q=X\cos\phi-R\sin\phi$. These equations establish the desired relationship between the errors at power factors of unity and cos ϕ.

Effect of Inductive Loads

Referring back to the first figure the voltage regulation (R) at 100 VA is 1.6 per cent. and the phase regulation is 10 minutes, or 0.29 per cent. of a radian (one radian = 3,438 minutes). Assuming that the transformer is to supply a burden having a power factor of 0.3, we have $\cos\phi=0.3$, and $\sin\phi=0.957$. Substituting these values in the above equations, $P=0.3\times1.6+0.953\times0.29=0.76$ per cent., and $Q=0.3\times0.29-0.953\times1.6=-1.44$ per cent.

From these results the voltage regulation at 100 VA and 0.3 power factor is 0.76 per cent., the ratio error is therefore +0.04 per cent.; the phase regulation is −1.44 per cent., i.e., the phase angle has increased by 1.44 per cent. of a radian, or 50 minutes, from the no-load value. The total phase error is thus +75 minutes.

If the meter has been calibrated using the unity power factor errors, the difference between the two sets of characteristics at 100 VA represents the error incurred. From this the voltage applied to the meter is 0.84 per cent. higher and 60 minutes in advance of its calibrated voltage and the meter will run 0.84 per cent. fast at unity power factor and 2.16 per cent. slow at 0.5 power factor lagging.

This method can be applied to any normal voltage transformer; it has been repeatedly confirmed by test results, and effectively solves the present problem.

Current Transformers

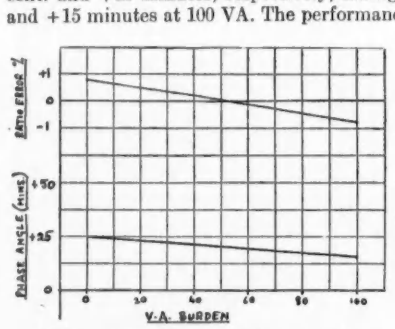
Current transformers work at a normal power factor of about 0.8 the effect of which is not readily calculable since the design of the transformer has to be taken into account. The inductive burden reduces the magnitude of the secondary current and positive phase angle and, if the line power factor is inductive, the effects will be additive, each tending to slow down the meter. Further, the error increases as the magnitude and power factor of the line load decrease with all normal current transformers, but a highly accurate transformer varies very little with change in burden conditions, whilst a poor one might cause an error of several per cent. on low loads.

Special Alloys

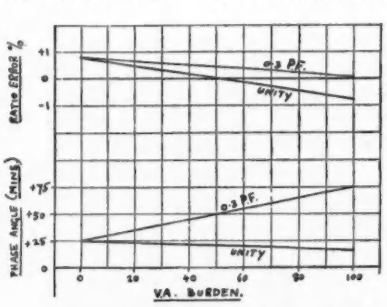
The best way of accounting for the errors thus incurred is to calibrate the meters with the transformers on every possible occasion, since this automatically compensates for all transformer errors. If this is impracticable a compromise plan is to minimise the error by using transformers of as high an accuracy as possible compatible with price limitations, usually by the use of (a) special alloys for the core (such as mumetal and permalloy), or (b) a large number of ampere turns.

The use of special core alloys is undoubtedly the best way of increasing accuracy, since this strikes at the root of all current-transformer error, i.e., the iron losses, but where the normal line current is low (under, say, about 400 amp.), the transformers must have wound primaries.

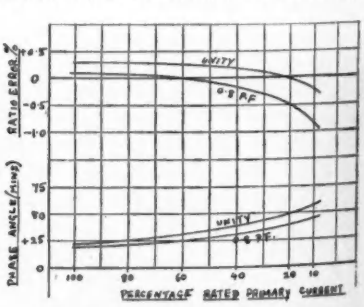
The wound-primary type of transformer has sometimes been regarded as unsafe under short-circuit conditions, but my experience is that failures seldom occur.



Voltage transformer with non-inductive burden



Voltage transformer characteristics



Characteristics of current transformer within Class B. limits of error

Electricity in Cloth Printing

Machine drives and control gear in the textile industries

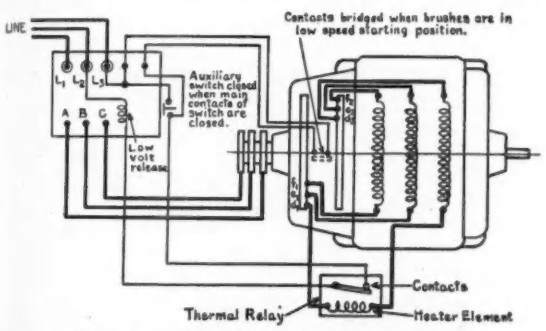
BY C. H. S. TUPHOLME

THERE are at last signs of some real improvement in the British textile industry and manufacturers in these and allied industries are now receiving more orders than at any time during the past two years. The printing branch of the textile industry is growing in importance because of the far greater attention paid to design in the world's markets, and also because of the improvements made in printing machinery and in printing materials. To-day, the calico printing machine is one of the most intricate in existence and it lends itself particularly to the electric drive in view of the conditions commonly encountered in print works.

There are many difficult problems to be considered when planning an electric drive. In the first place, print works are invariably hot and often steamy, though where the steam engine gives way to the electric motor the operating temperature is naturally reduced. In any case, it is essential for the motors installed to be somewhat liberally rated and well ventilated. Pipe-ventilated motors are often prescribed, as in the case of the four-colour printing machine with Williams-Janney variable-speed equipment, driven by a Metro-Vick motor illustrated on this page.

The A.C. Commutator Motor

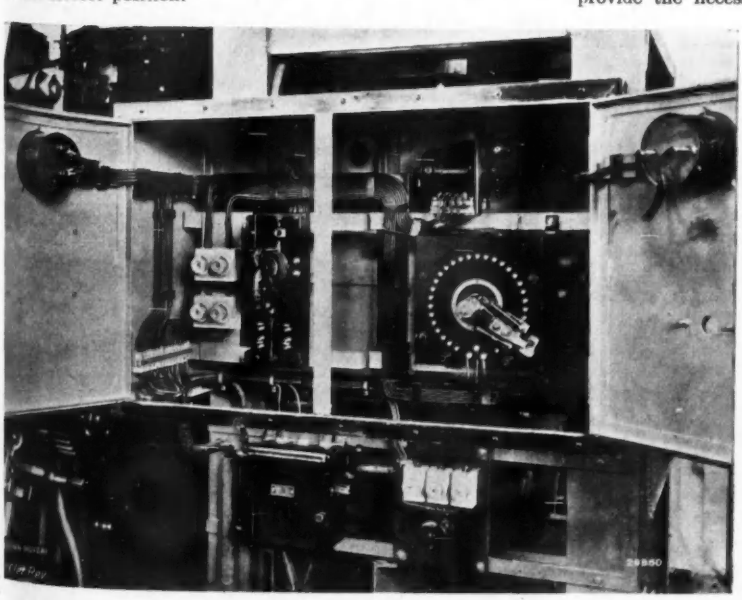
An efficient motor for this service is the a.c. commutator motor the speed of which is adjustable and remains practically


LINE
Contacts bridged when brushes are in low speed starting position.
Auxiliary switch closed when main contacts of switch are closed.
A B C
Low volt release
Contacts
Thermal Relay
Heater Element

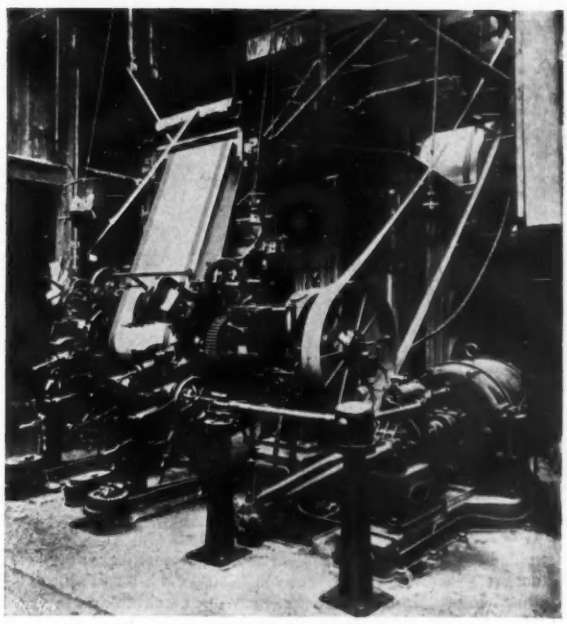
Connections for B.T.H. commutator motor

constant as adjusted, irrespective of the load. The adjustment is made by a handwheel, which acts as a controller with an infinite number of points, and any speed within the range can be obtained. Speed control from a distant point can also be used.

Normally, no starting gear is required; the motor is started by setting the brushgear in the minimum speed position and then closing the primary switch. Arrangements are made to prevent the motor from being started unless the brushgear is in the correct position.



Switch-cubicles containing control gear

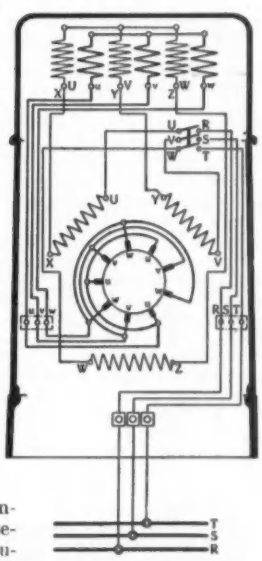


Four-colour cloth-printing machine

This type of motor is essentially an ordinary slip-ring induction machine, which has the positions of the primary and secondary windings reversed, with an additional winding and a commutator and brushgear. A primary switch only is necessary for starting the standard motor with a speed range of 2 : 1 or greater, since, provided the brushes are set in the minimum speed position, the current drawn from the line will be limited to about 1¼ times that at full load.

To ensure that the brushes are in this position when starting, a small switch operated by the brushgear and interlocked with the starting switch is fitted. In cases where the brushgear is electrically operated, the pilot motor employed for this purpose automatically resets the brushgear in the correct position for starting.

Motors with a speed range of less than 2 : 1 may need to have resistances inserted in the secondary circuit for starting, as with the ordinary slip-ring induction motor, in order to limit the starting current and provide the necessary starting torque.



The Brown-Boveri system

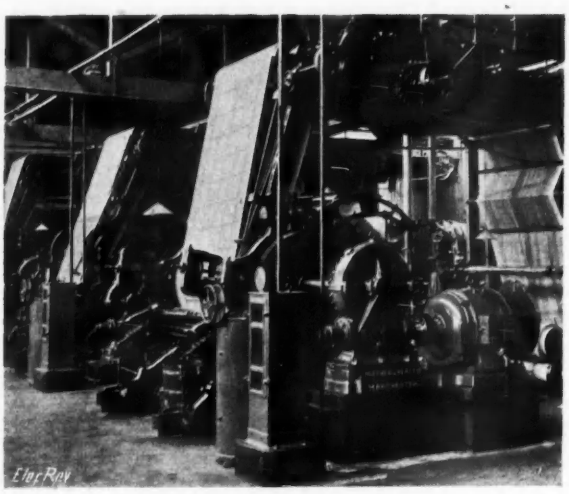
The Brown-Boveri three-phase commutator motor for cloth printing machines has a three-phase stator and a d.c. rotor. Current is carried to the commutator through carbon brushes, and the stator and rotor are connected in series through a transformer in the top of the motor casing.

The transformer reduces the rated voltage to the most favourable value for purposes of commutation. The motor is series wound.

A Remote-control System

A recent development by the same company is that of cloth-printing machinery drives with push-button control. The d.c. motors with Ward-Leonard control enable the speed of the motor to be adjusted for all working speeds and accurately maintained. All the contactors, the field regulator, and remote control, are contained in a small switch cubicle.

A typical example of this drive in a well-known Basle works is shown opposite.



A handkerchief-printing machine

A welded support of angle iron carries the motor, jockey pulley, reduction gear and switch cubicle. The push-button box is arranged inside the frame of the printing machine and is connected by cable to the control gear which is situated in the switch cubicle.

Two push-buttons, "in" and "out," operate the contactor, and two others, "faster" and "slower," control the servo-motor of the field regulator. When the button "in" is pressed, the machine starts slowly with the lowest inching speed. The push-buttons, "faster" and "slower" operate the remote control of the field regulator and enable the printing speed to be adjusted. When the button "out" is pressed the main motor is switched off and the field regulator is automatically returned to the starting position.

A special push-button is provided for intermittent adjustment when inching. The machine can always be stopped from the back end by two separate push-buttons fixed on the left- and right-hand sides of the frame.

The Ward-Leonard set delivers the direct current for the main and auxiliary circuits. It requires so little space that in the case illustrated it was possible to mount it without difficulty between the two printing machines. In general its position is naturally quite independent of that of the driving motors. A three-phase motor with centrifugal starter is direct-coupled to the Ward-Leonard machines, the variable voltage of which is supplied to the rotors of the driving motors. The small exciter feeds the field windings of all the machines and also the control gear in both switch cubicles.

Many printing establishments are running textile printing machines by Mather & Platt, driven by the same company's motors.

An illustration is given of the drive of Mather & Platt handkerchief-printing machine through worm gears by d.c. motors. The controller and resistance are shown at the front of each machine.

Transformers in Parallel

Methods of overcoming incorrect load division

WHEN two transformers, of similar nominal voltage ratings, are operated in parallel, they will share the load on the secondary circuit in proportion to their kVA ratings only if they have equal turns ratios and if their percentage reactance and resistance voltages are the same. On large distribution systems transformers of diverse types and ages are in use, which may not share their load correctly, due to differences in their impedance voltage; the total safe rating of a bank is then less than the sum of the individual ratings.

Incorrect load division is usually due to differences in percentage reactance voltages, which can be effectively corrected by the insertion of external reactance in the secondary leads of the transformers carrying the greater proportion of the load.

External Reactance

A convenient form of transformer reactance is an iron core of a hollow cylindrical form, through which the secondary conductor is passed. A longitudinal air gap is provided so as to give a linear voltampere characteristic to the reactance. As the ohmic value of the reactance will depend upon the length of the iron core, two or more units can be threaded on the same conductor so as to give a means of rough adjustment. Single-turn reactors of this type are suitable for transformers with a full-load secondary current of not less than 400 A.

The external reactance method is only suitable for obtaining a coarse adjustment, and is not so suitable where incorrect load division is due to differences in the turns ratio of the transformers or to inequality in the resistances of the connecting leads, as the voltage drop in the reactance does not compensate for the voltage unbalance due to these causes. A final limitation to the use of external reactance lies in the fact that, with this method, the voltage regulation of the bank is fixed by that of the transformer with the greatest impedance voltage.

The Balance-coil Method

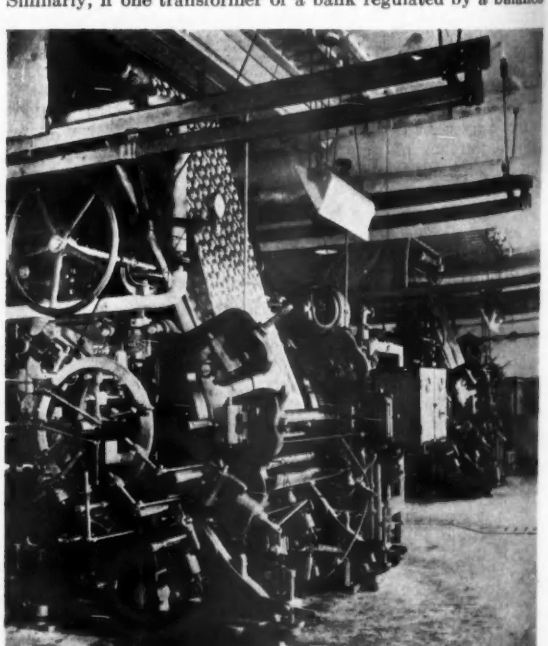
An alternative method of correcting for faulty load division is by the use of balance coils—a modified use of an iron core of exactly the same type as that used for external reactors, which is most suitable for transformers of equal kVA rating. One secondary lead of each of two similar transformers is passed through the aperture of the iron core in such a way that the currents in the two conductors flow in opposite directions.

The balance coil is thus similar to a current transformer, and tends to maintain the currents in the two conductors at an equal value. The magnetic flux in the core will be due to the difference in the currents in the two conductors, and it is this flux which sets up an e.m.f. in each of the conductors which tends to correct the current unbalance. By using a balance coil the regulation of a bank of two transformers is the average of that of the individual regulations, instead of being fixed, as it is when added reactance is used.

The action of the balance coil is automatic, and the dimensions of the core have not to be exactly proportioned to the requirements of the bank in order to compensate for incorrect load division. Further, as the correcting e.m.f. is set up by the difference of the two secondary currents, the balance coil will give good results when the incorrect load division is due to a difference in turns ratio or to unequal secondary resistances.

When the transformers operating in parallel have different ratings, the balance-coil method is not so convenient, as the nominal ampere turns due to each secondary conductor must be equal. If the ratings bear a simple ratio, the balance coil can be used by proportioning the turns of the secondary leads to these ratings. A multiple turn balance coil is, however, hardly practicable for any but small transformers.

Care must be taken in the installation of balance coils that the direction through the core aperture of the two conductors is correct, or the voltage set up by the flux will be due to the sum of the two currents, and the regulation will be very bad. Similarly, if one transformer of a bank regulated by a balance coil be removed, it will be necessary to withdraw the secondary conductor of the remaining transformer from the core, or, again, the regulation of this transformer will suffer.



Electricity in Cloth Printing: A Ward-Leonard drive

G. W. STUBBINGS, B.Sc., A.M.I.E.E.

O.L.A. Summer Meeting

The Overhead Lines Association has arranged to hold its annual summer meeting at Chesham on Friday, July 1st. By the invitation of the Chesham Electric Light and Power Co., Ltd., members will spend the day inspecting what the president, Mr. R. J. Jocelyn Swan, is doing on his system.

Thermal Storage Space Heating

Small scale applications

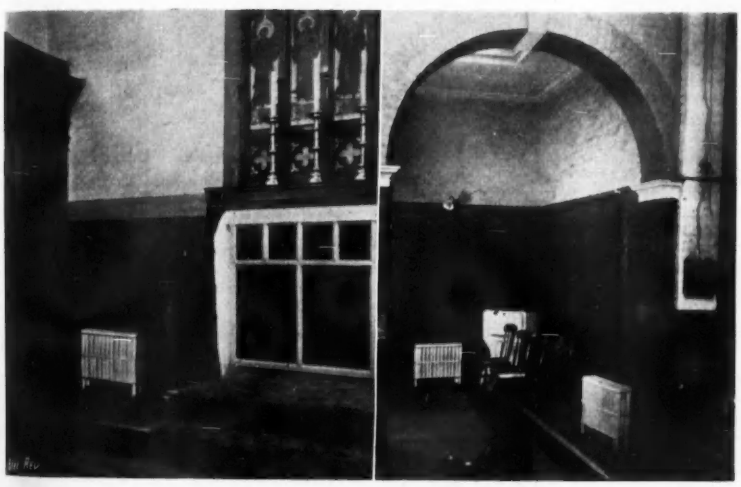
THE essential interest in two recently completed church-heating installations is not so much that they are thermal-storage schemes, but that the developments suggest the possibility of the application of the thermal-storage principle to small-scale space heating such as for domestic work.

We arrive at this conclusion because the scheme employs heating units, "Soapstone" radiators, produced by Soapstone Products Co., 6, Holborn Viaduct, E.C.1, with individual loadings no greater than 2 kW, and because similar radiators are available with loadings as low as 300 W.

This type of radiator possesses properties which make it very suitable as a heat storer. Apart from the element it is constructed from natural soapstone quarried in northern Sweden. The material has a great capacity for heat storage and also, apparently, a much greater ability for absorbing heat than for emitting it, so that even when it is not heat insulated, as is the case with all present designs, heat is accumulated while it is radiated in lesser degree.

The company has under consideration the production of a heat-insulated radiator, so that the heat emission can be more fully controlled with regard to time and direction. Models are available with loadings of from 0.3 to 4 kW, and with the elements entirely enclosed, so that the whole of the heat is transmitted through the stone, or with the elements exposed for partial direct radiation.

There are four standard sizes. The smallest measures 12¼ in. high, 3¾ in. deep and 14¾ in. long, and is available in the two styles—closed (300 W) and open (1,000 W). The closed model weighs 39 lb. A closed radiator with a maximum loading of 1,000 W and two-way switching (400 W alternative), and a radiator with a visible element loaded at 900 W, are similar in size and construction and have dimensions of 18¾ in. high, 4 5/16 in. deep and 13¾ in. long. The closed model weighs 76 lb.



Radiators in St. Gertrude's Church; one by high altar and two in entrance hall

They are designed for rooms of 1,000 cu. ft. volume. The smaller radiators are of one-piece (soapstone) construction, suitably recessed for housing the element, while the larger ones are made with three pieces of the stone—front, back and top—held together by metal end brackets secured with straight-through bolts. The elements are housed in the space between the back and front panels.

The two still larger sizes have maximum loadings of 2 and 4 kW, respectively, and as the installations referred to are equipped with the 2-kW model, which also seems to be the most suitable size, generally, for all situations, it will be sufficient to deal with that one only in detail.

It is constructed of turned pillars of soapstone, increasing the radiating surface, secured in a four-wall formation by metal bolts and capped with a soapstone slab. The shell thus formed encloses the elements which consist of resistance wire wound on soapstone block. A rotary switch provides three-heat control, with lower loadings of 1,000 and 500 W. The net weight of this radiator is 250 lb. and the overall dimensions are 24½ in. by 6¾ in. by 20½ in. high.

All the models are of pleasing appearance and natural in colour, and the soapstone may easily be kept in its original condition by slightly rubbing it with sandpaper when required.

It is always stimulating to hear Mr. Lesser of the City of London Electric Lighting Co., Ltd., discourse on space heating, and we were glad to have an opportunity for an interview after hearing that he had carried out some tests on one of the 2-kW radiators, the results of which are clearly shown in the thermograph charts on page 414.

Section of a soapstone quarry

The tests were carried out in Mr. Lesser's office, a room of about 3,000 cu. ft. situated immediately above the supply company's sub-station, with a window occupying nearly the whole of one end. Normally two persons occupy the room during working hours. The thermograph was placed near one of the walls about three feet from the floor and midway between the window and the opposite end.

Briefly, Mr. Lesser's conclusions are that the principle (small-scale thermal storage) is extremely good; that for certain conditions the radiator would be particularly suitable—including the replacement of ordinary radiators in some cases; but that the uniform emission of heat all round the equipment is a serious disadvantage where the radiator is situated very near a wall, because of the heat necessarily radiated into the wall. It seems to us that the heat-insulated model referred to will probably meet the last of these criticisms.

Electric has replaced gas heating at St. Gertrude's R.C. Church, Bermondsey, a building about 35 ft. square and 35 ft. high, where eight 2-kW soapstone radiators serve the church proper and one 1-kW model the sacristy.

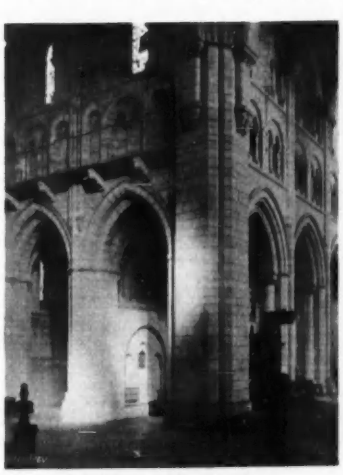
The eight larger heaters are placed one on either side of the high altar, one in the Lady Chapel, and one by the sacristy at the same end of the church, and two in each of the two entrance halls at the other end of the church.

Supply is received from the London Electric Supply Corporation, Ltd., at a very favourable rate from 7 p.m. to 7 a.m., and at the normal rate during the day. Change-over to each of the two meters is effected by a time switch.

The installation is also subject to hand control, and normally (during winter) the radiators are switched on at 11 p.m. and off at 7 a.m., but during very cold weather they are put in circuit at 7 p.m. and also for a short-period boost on Sundays. There is no other form of heating in the building and the improvement over the old method is most marked.

About 12,250 kWh was consumed in 114 days from October 21st, 1931, 11,837 kWh of which were chargeable at the night tariff.

Another installation employing soapstone radiators is in Buckfast Abbey, Devon, which was built entirely by the monks and possesses its own small hydro-electric scheme, intended originally solely for lighting supply. Twelve 2-kW models, supplied from the water-turbine set, are placed around the aisles and arranged in two banks of six each. During the day the banks are alternately switched on and off every two hours, and during the night the whole of the radiators are left on circuit each at half load.



Buckfast Abbey interior

During services only the heating is supplemented by twelve 10-ft. and twelve 8-ft. tubular heaters installed under the nave benches and choir stalls, and are served by a public supply from the Torquay electricity undertaking. The consumption per 24 hours was 400 kWh. with the soapstone radiators only.

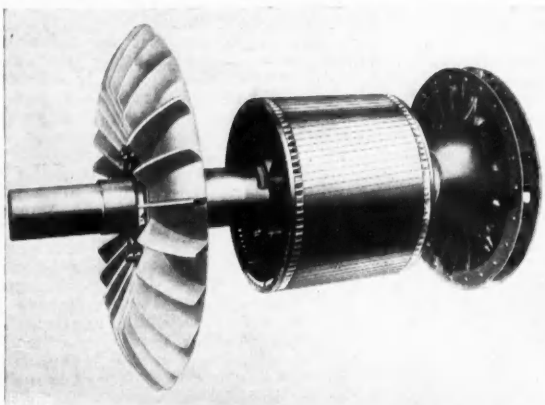
New Induction Motors

RANGES of totally enclosed fan-cooled slip-ring (type RW) and squirrel-cage (type RS) induction motors have recently been introduced by the Metropolitan-Vickers Electrical Co., Ltd., in sizes of from 30 to 500 h.p,. 1,000 r.p.m., 100 to 3,000 V, and for 25, 40, 50 and 60 cycles, for gas and coke works, boiler houses, &c., in dusty and exposed positions. The windings and internal portions are completely enclosed, all the sealing points consisting of accurately machined surfaces. No running labyrinth seals, other than those for the bearings, are used in the construction.

The motors are cooled by external air which is forced through ventilating ducts in the stator core, an internal fan circulating air in a closed circuit through the rotor and the internal portions. Power factor is high over a wide range of loading.

In the larger high-voltage machines the stators have concentric windings in semi-closed slots. For the s.c. rotors the slots are skewed to ensure quiet running, the windings consisting of stout copper bars electrically brazed to end rings.

The internal air is circulated by a steel fan keyed and shrunk on to the shaft, while the external fan is cast in semi-steel or " M.V.C." aluminium-silicon alloy and spigoted and bolted to a cast-steel hub at the driving end of the machine. This



Rotor of " RS " totally-enclosed, fan-cooled motor

has the advantage that the air is distributed at a low velocity away from the drive, thus causing a minimum disturbance of dust.

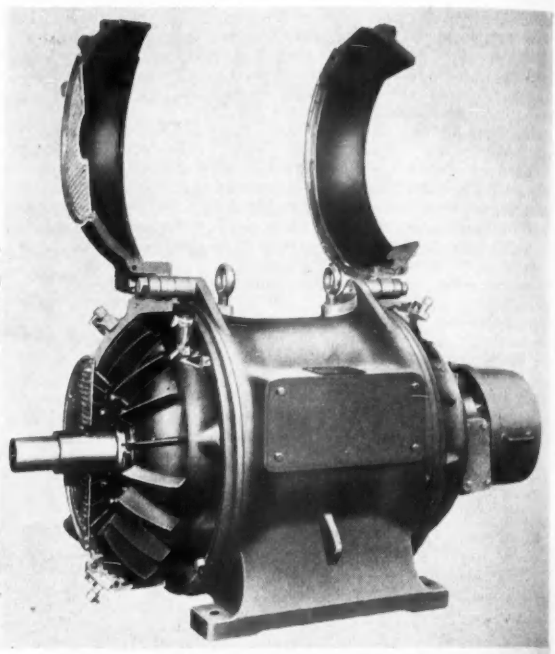
In the outer air circuit dust extraction is effected before the air is passed through the axial ducts in the stator core. The cast-iron cowls which shroud the fan form a dust trap for any dirt passing in with the cooling air. Cleaning of the dust trap is facilitated by the cowls being hinged.

The bearings are mounted in special cartridge-type housings which enable the end brackets to be removed and the motor completely dismantled without disturbing the bearings in any way. Either a sliding baseplate, now adopted as standard, or slide rails can be supplied.

The rotor windings of the smaller type " RW " motors are composed of former-wound coils of taped copper strap, the complete rotor being impregnated with special insulating varnish and thoroughly baked. In the larger sizes a bar winding is used, and individual bars are insulated, impregnated and dried before being inserted in the slots.

In the smaller sizes the slip rings are mounted on a hard moulded composition insulating sleeve, while in the larger patterns they are mounted on an insulated cast-iron hub.

Both types of machines are continuously rated to comply with B.S.S. No. 168-1926. The difference between full- and no-load speeds varies from about four per cent. for small motors to 1.5 per cent. for the large ones—on 50-cycle circuits, and

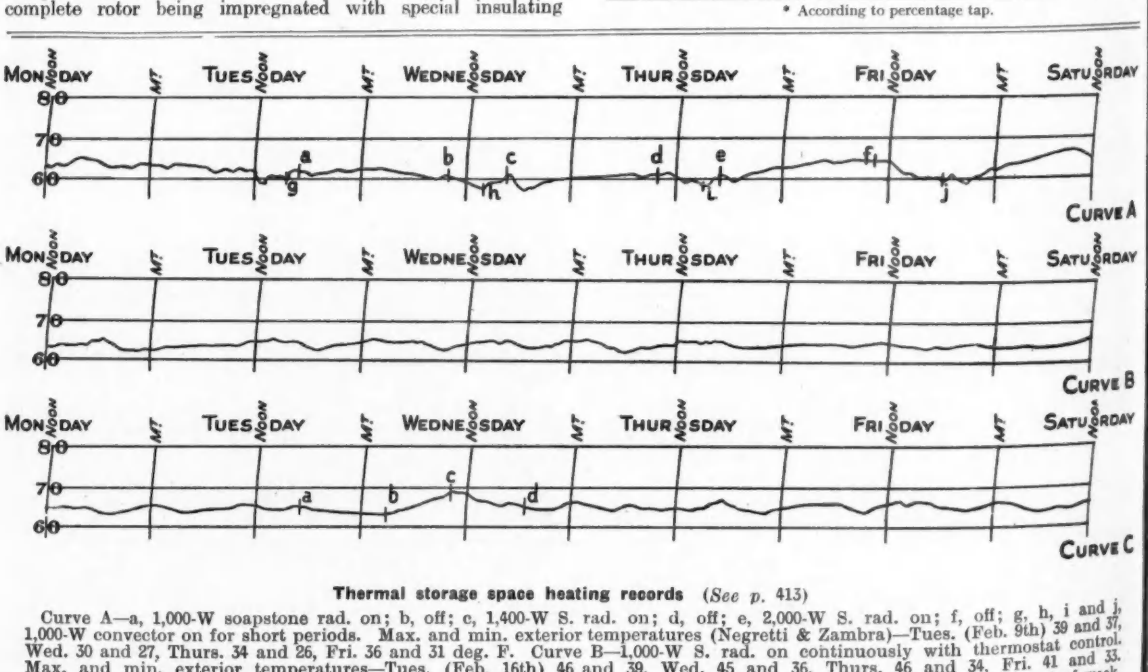


" RW " motor; end cowls raised, showing cooling fan, &c.

these differences are increased by about 50 per cent. on 25 cycles. Type " RW " motors can be started up under full-load or overload conditions, the starting current being little more than the normal current for any particular load. Average (only) values for type " RS " 50-cycle motors are given in the following table :—

Type of starter.	Direct 2- or 3-phase.	Star-delta 3-phase.	Auto-transformer.
Line voltage at motor terminals (per cent.)	100	58	50 to 75*
Full load starting torque (per cent.)	100 to 125	33 to 42	25 to 70*
Full load starting current (per cent.)	400 to 500	135 to 170	100 to 280*

* According to percentage tap.



Thermal storage space heating records (*See p.* 413)

Curve A—a, 1,000-W soapstone rad. on; b, off; c, 1,400-W S. rad. on; d, off; e, 2,000-W S. rad. on; f, off; g, h, i and j, 1,000-W convector on for short periods. Max. and min. exterior temperatures (Negretti & Zambra)—Tues. (Feb. 9th) 39 and 37, Wed. 30 and 27, Thurs. 34 and 26, Fri. 36 and 31 deg. F. Curve B—1,000-W S. rad. on continuously with thermostat control. Max. and min. exterior temperatures—Tues. (Feb. 16th) 46 and 39, Wed. 45 and 36, Thurs. 46 and 34, Fri. 41 and 33. Curve C—1,000-W S. rad. on till a; 2,000-W S. rad. on o; off c; 1,000-W S. rad. on d with thermostat control for rest of week. Max. and min. exterior temperatures—Tues. (Feb. 23rd) 48 and 44, Wed. 48 and 40, Thurs. 45 and 40, Fri. 46 and 38.

The Sydney Harbour Bridge

Electricity's part in its construction

THE official opening of the Sydney Harbour Bridge, New South Wales, to-morrow (March 19th) marks the completion, after nearly seven years' work, of an undertaking, first suggested in 1815, that will rank as one of the great engineering feats of the century.

Electricity may almost be said to have "built the bridge," for during the period of its construction, the use of electric power and light has been on a most extensive scale, as will be appreciated from the fact that the General Electric Co., Ltd., through its associated company, the British General Electric Co., Ltd., Australia, not only supplied motors totalling over 8,000 h.p. in capacity for the driving of cranes, air-compressors, stone-crushing machinery and auxiliary workshop plant, but also some 12,000 "Osram" lamps for lighting purposes, and innumerable electrical accessories and fittings in the form of bell and telephone systems, heating and cooling equipments, cables, insulators, switches, plugs, lampholders, ceiling roses, batteries and fans, in addition to the necessary equipment for a sub-station to supply power.

Large Electric Cranes

Electric motive power was necessary in the very early stages of the undertaking for the operation of large cranes and hoists to handle the raw materials in the stock yard, and to install heavy machine tools in the constructional shops. Two of those cranes, each equipped with a 220-h.p. motor and capable of lifting 120 tons, were mounted in the "heavy" shop where every member of the bridge was laid out and assembled before actual erection on site. Some idea of the enormous weights dealt with may be gained from the fact that the end section of the lower chord of the bridge weighs 240 tons.

The building of the workshops necessitated the installation of a very complete lighting equipment controlled from a main G.E.C. switchboard. At every few yards were placed points

The new bridge

from which long leads fitted with lamps could be taken to any position required by the engineers.

During the erection of the workshops, excavation work was proceeding on each side of the harbour to accommodate the 80-ft. square skewbacks against which the end bearings of the bridge are braced. Pneumatic drills supplied with air from electrically-driven compressors were employed to excavate 40 ft. into solid rock. The power for the compressor motors was taken from the overhead line of the N.S.W. tramways through two G.E.C. balancer sets (one on each side of the harbour) which provided the required voltage. As soon as the excavations were completed these compressors were used to supply air for riveting work on the bridge itself.

Preliminary activity was not confined to the bridge site, however, for at the town of Moruya, 150 miles south of Sydney, a granite quarry was producing stone for the pylons of the bridge and aggregate for the cement to build the skewbacks and retaining walls. The power in this quarry is entirely electric; energy is generated on the site by two 200-kW Diesel engine driven G.E.C. generators feeding 20 "Witton" motors driving stone crushers, air compressors, overhead cranes, and conveyors to ships at the wharfside. At Moruya, Dawes Point, and Milsons Point the motor drives total nearly 5,000 h.p. in capacity.

Lighting During Construction

Eventually, work on the bridge proper began and in the erection of the upper and lower chords it was necessary for engineers and riveters to work inside the bridge members by artificial light. For this purpose a temporary lighting service had to be provided with points at 20 ft. intervals, the lamps being connected to leads of Pirelli-General cable carrying current at only 32 V. At the most dramatic moment in the course of the erection—the final joining of the arch—a battery of 200-W "Osram" lamps was requisitioned to flood the scene with light, so that the work could proceed throughout the night.

This temporary service was later superseded by a permanent installation to provide light for the painters who will be employed continuously painting the bridge. Twelve miles of solid drawn galvanised conduit was supplied for this lighting scheme.

The most spectacular lighting system installed by the British General Electric Co., Ltd., is, however, that for the main

Giant cranes in one of the constructional shops

illumination of the bridge when it is opened. Special units are employed, fitted with refractors to distribute light across the bridge. As rail and tramway traction, as well as motor and passenger traffic, will use the bridge, the problem of illumination naturally engaged a great deal of thought, and the research department of the company at Wembley, England, evolved for the purpose a refractor of one-piece glass with prisms so arranged that the light will be directed on the road area only, there being a definite cut-off at the back, so that no light will encroach on the rail and tramway tracks. These refractors will also control the light in such a way that there will be a definite anti-glare cut-off so far as motor traffic is concerned. Over 150 of these refractor units will be mounted in the bridge lanterns on either side of the approach roadways and of the main span roadway.

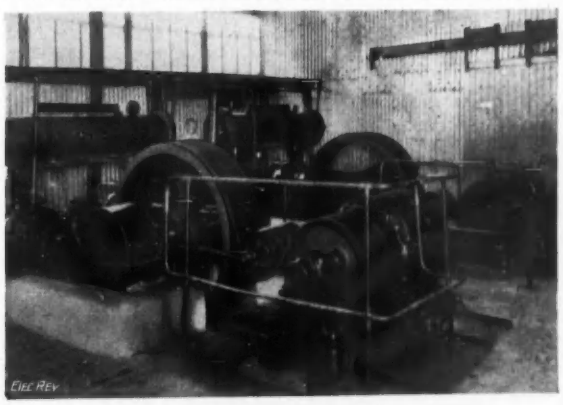
The lighting of the bridge includes sixteen striking concrete columns placed at the northern approach, on which are mounted octagonally shaped lanterns fitted with diffusing glassware, each being equipped with twelve 60-W lamps. Huge glass-sided concrete standards housing a number of high-wattage lamps are likewise installed at the southern end.

Roadway Illumination

The actual lighting of the main traffic section of the bridge is contrived by a large number of specially made lanterns incorporating an entirely new system of light distribution and control by means of "Wembley" non-axial asymmetric prismatic refractors. The light source in each of the 157 units installed is a 300-W "Osram" lamp.

The refractors are of the 160-deg. non-axial type, designed for distributing the major portion of the light from the lamp along and towards the centre of the roadway. They are single-piece glass refractors having vertical prisms on the internal surface, with horizontal prisms on the outer. They are mounted in a special form of adaptor carrier for installation in the permanent lanterns supplying the main span and roadway approach lighting, and are fitted to the suspension device by means of lugs, which are an integral part of the refractor.

A focusing arrangement is incorporated and is so constructed that the whole of the interior lighting unit can be removed from the lantern for cleaning purposes. The complete interior



The compressor plant

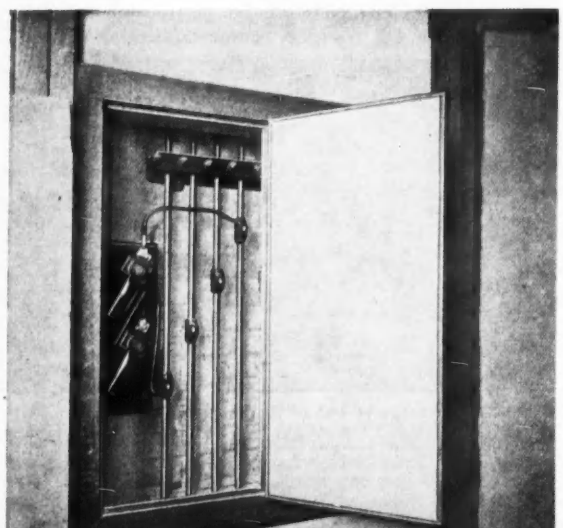
and method of suspension has been made the subject of a patent application under the Australian Patent Act.

Messrs. Holophane, Ltd., inform us that 140 of their refractors were specified and installed for the lighting of this bridge.

The building of the bridge was carried out by Messrs. Dorman, Long & Co., Ltd.

Distribution in Buildings

THE number of building wiring installations which have been, and are being, completed with the "Riserrod" system of distribution introduced by Messrs. Grierson, Ltd., to overcome objections to the use of ordinary cables for rising



Tee-off "Riserrod" mains in a London store

mains indicates the increasing importance that is being attached to the scheme. Solid copper rods or tubes insulated with closely fitting sleeves of micanite 1 mm. thick are employed.

The distributing boards are laid out as nearly as possible vertically above each other. One set of rods or tubes is run vertically from the basement to the roof of the building, and current required for all purposes is taken from the "Riserrod" to the floor fuse boards by short lengths of cable of the normal type. Connecting the floor fuse boards to the "Riserrods" is effected by cutting away short lengths of the thin micanite sleeve, applying a clamp to the rods and connecting the cable to the clamp.

By grouping the whole of the supply on the one set of conductors any normal addition to the connected load forms only a small percentage of the *total* load, whereas it would form a substantial addition to the floor load. Further, as normal temperatures have no effect on the micanite insulation there is really no practical limit to the loading of the mains, whereas rubber and paper insulation would be seriously damaged.

An additional advantage of the new method is that if very large increases in the load were called for, which would seriously overload even the "Riserrods," larger diameter rod could be inserted, and the recovered material would have a value substantially approaching its original value.

In the case of a local floor fire, or of flooding, the "Riserrods" would suffer little or no damage.

At Messrs. Derry & Toms' new store building in Kensington, a vertical *loop* or "ring main" of 1¼ in. diameter "Riserrod," designed to carry approximately 1,000 h.p., completely encircles the lift shafts. Horizontally, along the top, the supply to the large battery of lifts is tapped off. As the rods descend through the various floors, tappings are taken off to the local fuse boards, and on the horizontal run through the basement current is tapped off for the power requirements of the ventilating fans, pneumatic tubes, &c.

Another building, of an entirely different type, to be equipped with the system, is the municipal office block of the Southampton Civic Centre, now approaching completion. This building is only three floors high, but it has an overall length of 340 ft. and an overall width of 130 ft. A "ring main" of ⅝-in. diameter rod has been fixed in the void to the suspended ceiling of the basement corridor, and at eight points, distributed about the building, rising mains each having a capacity of approximately 100 h.p., are installed. Adequate supplies of electrical energy are thus made available in any room in the building, *via* the suspended ceilings to the corridors, and may be obtained at any time without any disturbance to the structure or to the decorations.

Parliamentary Notes (BY OUR SPECIAL REPORTER)

The Teleprinter

On March 9th, Mr. L. Smith asked the Postmaster-General what was the cost of the teleprinter to the Post Office itself and what would be the comparative cost of hiring out a machine to a member of the public; whether he proposed to sell the machine outright to a potential purchaser; and, if not, why not.

Mr. H. G. White, the Assistant Postmaster-General, said that it was not in the public interest to publish contract prices. As regarded the last part of the question, in order to provide satisfactory service by means of teleprinters working over telephone lines, maintenance by specially trained staff was essential, and this was covered by the rental. Those who desired teleprinters for use over their own lines or over leased telegraph lines would be able to buy direct from the manufacturers.

Postal Workers

On March 9th, Sir K. Wood informed Mr. G. Macdonald that the total number of Post Office workers employed on January 1st, 1932, the latest date for which figures were available, was 231,169. The corresponding figures for the years 1929-1931 (January 1st) were as follows:—1929, 228,598; 1930, 229,440; and 1931, 230,711.

Gas or Electricity?

On March 14th, the Kettering Gas Bill came up for second reading in the House of Commons. This measure is promoted by the Kettering Gas Company. The Kettering Urban District Council, which is the electricity authority for the district, precludes the use of gas on its housing estate. The Bill seeks to empower the Gas Company to lay mains and supply gas in this area, and Clause 6 seeks to remove the restriction on the supply of gas on the Council's housing estate.

Lt.-Col. Watts-Morgan (Rhondda, Lab.) moved the rejection of the Bill. He protested against a circular letter which had been sent to members of the House by the National Gas Council. That letter appeared to question the right of members to take such action as they thought fit on the Bill. The Bill was an attempt on the part of a private company to "lay itself on a pitch" which had cost the ratepayers a considerable amount of money. The Kettering Council, which owned the electricity works, passed a resolution that electricity only should be used in its own houses, while the gas company had the right to supply gas elsewhere in the urban district. He asked the House to reject the Bill, which would impose a burden on the urban district of Kettering, where a large amount of the ratepayers' money had been invested in the electricity works.

Mr. McEntee (Walthamstow, Lab.) seconded the rejection. He contended that the local authority should be able to lay down what conditions it thought desirable for its own houses, and argued that houses lighted and heated by gas cost double in decorations as compared with electrically-lighted and heated houses. From every point of view meals electrically cooked were better and cheaper. He questioned the right of any private organisation such as the Kettering Gas Company to endeavour to settle such a large question of national policy as was here involved by private Bill procedure. No tenant on the Kettering Council's housing estate had asked that gas should be installed.

It was apparent, however, that the general feeling of the House was in favour of the Bill getting a second reading and being examined by a Select Committee. Mr. Clarry (Newport, U.) described the agitation against the Bill as "artificial," and said there was no adequate reason for it. The Bill gave freedom for the supply of gas and freedom to the tenant to take the gas if he wanted it.

Mr. Eastwood, the member for Kettering, said that the local feeling was that the tenant should be allowed to have his own choice—either gas or electricity.

Mr. Briant (Lambeth, N.L.) very strongly resented a landlord, whether municipal or private, interfering in the details of a man's judgment as to his own convenience and taste. Dr. Howitt (Reading, U.) argued that it was wrong to give any local authority the power to force either gas or electricity on its tenants.

In the debate which followed, Mr. Lovat-Fraser (Lichfield, Nat. Lab.) said that the spirit behind the action of the local authority was tyranny and oppression. Wherever that spirit showed its head it was the duty of the House of Commons to check it.

Mr. E. Brown, speaking for the Government, said that it was the clear opinion of the Minister of Health that the Bill ought to go to a Committee, where the issue could be thrashed out, evidence heard on both sides, and a reasoned decision come to.

The motion for the rejection was negatived, and the Bill was read a second time.

Payment for Qualifications

The Plymouth City Council has referred to its Establishment Committee a proposal that officials possessing certain professional qualifications (including membership of the Institution of Electrical Engineers) shall receive a grant of £50. This amount would be merged in their salary in future years, provided that the maximum of any grade was not exceeded.

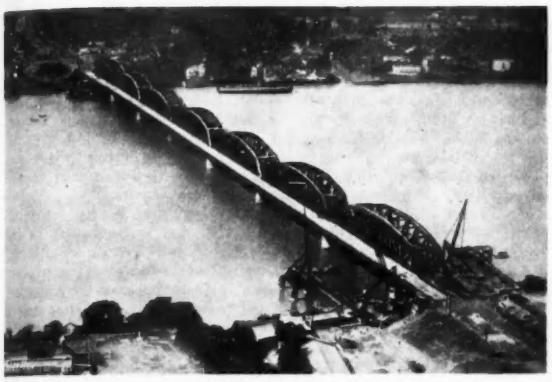
MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Hydrogen Production as an Off-peak Load

HYDROGEN and its uses are discussed in the paper which Dr. E. F. Armstrong read at the ROYAL SOCIETY OF ARTS on March 16th.

Whenever pure hydrogen is required its production by the electrolysis of a dilute solution of caustic alkali in distilled water is indicated. The largest item in the cost is power and, though the distribution of the compressed gas in steel pipes over some miles is feasible, it has not yet proved economic in competition with the manufacture of the gas at the point where it is to be used. One of the prime problems (owing to its lightness) is storage, which for any quantity in weight involves large holder capacity. The generation of hydrogen for industrial use from the off-peak power of the electricity generation stations, which can be supplied at a nominal cost, offers great potentialities and would be even more attractive if this question of storage could be solved.



The Bally Railway Bridge, India, which is lighted by means of about 120 Revo "Nigeria" fittings

Cells have been suggested in which the electrolysis is carried on under pressure, so that the cost of compressing the hydrogen for use in pressure synthesis is saved: if perfected this will have many advantages.

A special and most interesting application of hydrogen is in connection with the atomic welding arc, an arrangement of a jet of gas through which an electric current is sent. The hydrogen molecules are dissociated into atoms by the electrical energy and these not only exert great chemical reducing power, but by their interaction they produce localised extreme heat suited for reducing and welding most of the refractory metals.

The device, so simple in appearance, is the outcome of many years of experiment. Having studied the dissociation of hydrogen molecules for a dozen years, Langmuir found that the recombination of hydrogen atoms to form molecules actually evolved more heat than the combination of hydrogen and oxygen. The high temperature of the flame, together with its powerful reducing action and the avoidance of gases containing oxygen and nitrogen, render the torch particularly useful for welding, not only iron and its alloys, but also such metals and alloys as contain aluminium, magnesium, chromium, manganese, &c.

Substances of very high melting point can be melted with it: the important uses of tungsten in the electrical industry are based on this flame; indeed, the gasfilled lamp is the direct result of experiments made for the purpose of studying atomic hydrogen.

Electric Welding May Revolutionise Shipbuilding

SHIPBUILDERS have not only succeeded in standardising the various parts that make up a vessel's structure, but even the methods of fabricating those parts and of putting them together.

So much is this the case that there would appear to be little to say that is fresh about steel shipbuilding, but Mr. N. M. Hunter concludes the paper which he read before the NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS on March 11th at Newcastle-on-Tyne by stating that we are on the eve of what may be a revolution in ship construction by the development of electric welding.

Not only has it been proved practicable to build an all-welded ship, but some builders are, in fact, prepared to quote an alternative and, says the author, cheaper price for a ship built by that method. Such rapid progress has recently been made in electric welding apparatus, electrodes, and methods that it appears possible now to produce a structure by this means which is not only stronger than the riveted structure, but also from 12 to 20 per cent. lighter.

The author hopes this subject may receive the most careful consideration of the great classification societies, and he asks them to approach it from a research point of view with the object of assisting both builders and owners to take full advantage of this new method of construction, which now gives promise of being an improvement on existing methods.

The advantages which appear obvious in considering electric welding as applied to steel ship construction are: (1) Strength combined with lightness. (2) The absence of all danger of leakages on account of eliminating the riddling of the plating with innumerable holes which have to be filled up with rivets or by other means. (3) The absence of all caulking, which, at the best, is destructive to the solidity of the riveted overlap by the burring up of the edge of one plate and the consequent hollow space caused between the two plates of the joint.

This prising up of one plate from the other, which is inevitable in all caulking, tends also to reduce the friction of one plate on the other and so reduce the practical holding power of the joint.

Mr. Hunter also sees possibilities of lightening not only the hull by the elimination of connecting flanges, overlaps, rivet heads, etc., but also the framework of the machinery where it might be possible to introduce a light welded steel structure as rigid as the present comparatively heavy and clumsy cast iron framework.

Why Circuit-breakers are Inconsistent

IN the paper on the design and performance of oil-immersed switchgear which Messrs. H. Pearce and T. T. Evans read at the INSTITUTION OF ELECTRICAL ENGINEERS on March 17th, they express the opinion that the principal cause of inconsistency in the short-circuit performance of oil circuit-breakers is the erratic movement of the oil. Quick-break circuit-breakers are advantageous for the higher voltages, and still further improved performance and consistency is obtained by the use of suitably designed contact shrouds.

Reference is made to published tests on some of the recent designs; the principal features affecting arc rupture are briefly reviewed and are followed by notes on the causes and effects of the magnitude and the rate of rise of recovery voltage.

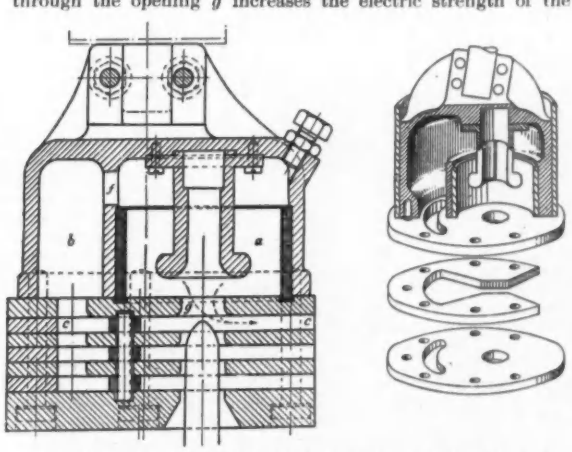
The importance of short-circuit testing is emphasised, and a plea is made for facilities for testing on site. A description of short-circuit testing arrangements is given, including a detailed description of the oscillograph equipment; also general notes on the calculation of three-phase kVA and tests on circuit-breakers fitted with a new type of shrouded contact.

Cross-jet Explosion Pot

There has recently been developed a shrouded contact which utilises the gas pressure developed in the explosion-chamber type of shroud to direct a stream of gas and oil vapour in a "most favourable" way for maximum turbulence and dispersion. The explosion pot (illustrated) is fitted with a number of insulating plates which form a series of passages at its open side.

During the first part of the stroke, the pressure generated in chamber *a* is partly relieved by the direct leakage around the contact plunger in the opening *g* and is also communicated to chamber *b* through the opening *f*, causing a leakage of oil through the horizontal passages.

When the contact plunger has moved to the position indicated in the left-hand figure, most of the oil escaping from chamber *b* will pass along the horizontal passage *cc* towards the arc, thus increasing the rate of generation of gas until the current approaches its zero value. When the value of the current has fallen sufficiently low, the mixing of the comparatively cold oil with the hot gases escaping from chamber *a* through the opening *g* increases the electric strength of the



Cross-jet explosion pot; and exploded view of the pot

fluid in the direct path of the arc and tends to prevent re-establishment. Further movement of the contact plunger provides additional horizontal passages and intensifies the action.

Conclusions

It may fairly be claimed that the art of arc rupture in oil has made a marked advance in the past two or three years. The use of a shrouded contact offers very considerable advantage over the earlier types of circuit breaker, in obtaining shorter arcing time, less indication of distress, and more consistent results. Instrument equipment is available for obtaining adequate and accurate information from short-circuit tests.

When the rated breaking capacity which it is desired to prove is beyond the kVA capacity of the test plant available, an oil circuit-breaker with shrouded contacts can be tested successively to prove its suitability to handle high voltage and high current separately, and the combined results of such tests are a guide to its behaviour under full-capacity conditions.

Pneumatic Road Excavation

TO those responsible for laying the miles of electricity, telephone, and telegraph cables and pipes which are buried beneath our roadways, the available tools operated by compressed air are a boon, says Mr. D. Y. Marshall in the paper which he read before the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on March 8th.

Although many companies have availed themselves of the benefits of portable pneumatic plant, there is still a great deal of hand excavation going on in our streets, especially by the big public utility concerns, most of which is purely maintenance work on which the use of truck-mounted compressors and the right tools would pay for themselves in a very short time.

Discussion and Questions

Most of the speakers in the subsequent discussion asked for further information. Mr. Linscott suggested that the use of the clay shovel or power pick for cable laying or maintenance work in towns was ruled out by reason of the existence of gas, water, and other services under the streets, and the possible damage which such tools might cause.

Mr. J. P. Morley said that whilst there seemed to be scope for the use of pneumatic tools for headings and for tunnelling, it would be expensive to carry a special plant for occasional work of that kind. It was possible that the plant could be hired. Mr. Hancock described an experiment in which clay digging by means of pneumatic tools was compared with digging by hand. The result had proved to be that, unless exceptionally hard clay had to be dealt with, the use of the pneumatic tool did not lead to much economy.

Mr. I. Lockwood said that for drawing in cables one required 1¼, 2, or 2¼ tons capacity, and he asked whether a truck-mounted portable compressor was made suitable for dealing with such capacities. Mr. W. F. Andrews (chairman) stated that his undertaking had tried to use silencers, and the effect had been to slow the machine down. The silencers were rather unwieldy, though flexible, and had certainly eliminated at least 50 per cent. of the clatter. If hoists were to be suitable for hauling in cables they must exert a slow, steady pull. He agreed that pneumatic tools enabled one to carry out work more quickly than by man power, but they were not cheap to buy or maintain. Portable compressors mounted on motor trucks were expensive, and his undertaking had found it cheaper to use one which could be drawn by a horse to the site at which it was to work, and then man-handled if it was necessary to move it a few feet.

Mr. Marshall, replying to the discussion, said that pneumatic shovels were used only for freeing the clay, which was lifted by men. As to the driving of a portable compressor by a lorry engine, if the h.p. of a truck engine were increased a higher tax had to be paid on it. Pneumatic tampers and clay spades were being used extensively in other countries, but not here, partly because so many services were buried in a haphazard manner under the pavements. If gravel could be shovelled up, one would not use an air tool, but if it had to be loosened a fairly heavy clay spade could be used with advantage.

Cost of Plant

A portable compressor for two concrete breakers, fitted with a petrol engine, cost from £300 to £350, and a concrete breaker cost £30 to £45. Two lengths of hose were also necessary, and two dozen steels. The quantity of air required for a clay spade was little more than half that required for a concrete breaker.

Air-operated hoists of capacities up to 25 tons were available. The petrol-driven tamper was introduced from the Continent fairly recently, but the air-driven tamper was very light. Several companies hired out air plant, but charges were high on account of maintenance costs.

The Future of Steam Raising

MR. JOHN BRUCE'S paper at the INSTITUTION OF ELECTRICAL ENGINEERS, which was referred to in our last issue, p. 382, was read and discussed at the Institution on March 10th. Mr. W. M. Selvey, who opened the discussion, remarked that the paper disposed of the contention that turbines had practically reached their limit of efficiency, but that there was much leeway to make up in the boiler house. Numerically the figures of merit for steam raising and steam utilisation were now equal, and the credit for that was due to pulverised fuel.

Further improvement would come from the better utilisation of materials. The problem was now one of the furnace type boiler, practically without refractories. Side by side with this was the improvement of the "cycle," which, by means of higher pressures and temperatures, was increasing the available energy per lb. of working fluid, another way of getting more service from less material.

In the struggle to compete with the newer efficiencies, the use of hot air in stokers had, in many cases, been pushed beyond a practical limit and, at any rate with certain classes of coal, experience had shown that in order to get complete combustion it was necessary to drop grate temperatures and thoroughly wet the coal. Otherwise large masses of unburnable coke formed in the furnace.

Superheater design was now being appreciated as of great importance, and this need had induced engineers to make a particular study of its problems. The higher temperatures were mostly to be found on the Continent, with the exception of the new Delray experiment, which aimed at 1,000 deg. F., whereas about 900 deg. F. was the aim in France and Germany. Air heaters had been giving a little trouble, but for stoker work the moderate temperatures required presented no permanent difficulty.

A Detroit Plant

Mr. Selvey gave a brief résumé of a long and detailed communication from his son, Mr. A. M. Selvey, who is with the Detroit Edison Co., in which details were given of the No. 3 Delray plant mentioned in the paper. This is a stoker-fired plant, and was preferred to pulverised fuel owing to the station being in a crowded area of the city. At the same time the boiler is so designed that it can be changed over to pulverised fuel with little modification. The output required had necessitated a stoker of 611 sq. ft. grate area and a special construction had been adopted for automatically controlling the air supply to a large number of separate sections of the stoker.

The net result of this automatic control had been greatly to increase the efficiency of firing. Tests had also shown a CO_2 content as high as 16.5 per cent., a figure generally attributable to pulverised fuel firing only. The boiler had an output of 410 000 lb. per hour. It was now recognised that the design of the Stirling type of boiler necessitated special provision for the superheater.

Mr. W. N. C. Clinch expressed surprise that so much was said of American practice in the paper. Having regard to the efficiencies obtained with the author's own plant he had not yet lost faith in British boiler makers or central station engineers. Pulverised fuel firing did not conduce to simplicity because it meant using all sorts of auxiliary apparatus to make the coal suitable, and unless a pulverised fuel plant occupied approximately the same space as that of a stoker plant simplicity was not secured.

However, if pulverised fuel firing had to be used, the unit system seemed to have the greatest advantages. It was impossible to expect a perfectly clean chimney during soot blowing, and it would be a long time before the difficulties of grit collection with pulverised fuel firing were overcome.

London Companies' Practice

Mr. H. P. Gaze suggested that the author's ideal figure of 5.5 lb. per sq. ft. of heating surface was a very low one, having regard to the figures obtained in the most advanced practice. At one of the London Power Company's stations archless stokers were installed, and boilers nominally rated at 60,000 lb. per hour were steaming at 90,000 lb. and had been up to 100,000 lb. with 15 per cent. CO_2, and over, without any trace of CO. It was utterly impossible to make those boilers smoke.

A certain type of American chain grate stoker, modified to suit British coals, was working very satisfactorily at Deptford, and a still further modified type of the same design, similar to the stokers to be installed at Battersea, had been working for four years, the nominal rating of the boilers being 160,000 lb. per hour, although 200,000 lb. had been reached. Again, there was no difficulty with smoke; water walls were fitted. The maintenance costs were 3½d. per ton of coal burned, which was comparatively high, but was due to the modifications that had been made and should ultimately come down very considerably. For that size of boiler he believed those stokers would be strong competitors of pulverised fuel firing, with a great decrease of atmospheric pollution.

The work being done at Grove Road in gas washing had demonstrated that a boiler which had not been cleaned for a fortnight could be soot blown in one operation and completely cleaned without the slightest sign of grit or dust coming from the stack.

A French Example

Mr. W. E. Highfield said that through the courtesy of M. Rauber of the Union d'Electricité a mass of information relating to the latest boiler house practice of that company was available and would be sent in for the I.E.E. *Journal*.

The Vitry (South) power station had been in commission for several months and it embodied the very latest practice for a high efficiency base station. The original boilers at the Gennevilliers station had been reconstructed. Vitry (South)

had become the true base load station and Gennevilliers more of a peak load and stand-by station. The two boiler houses differed in design to suit these different conditions. The Vitry (South) boiler house contained two boilers, each for 240,000 lb. per hour economical rating and 300,000 lb. per hour maximum, at a pressure of 500 lb. and a temperature of 840 deg. F.

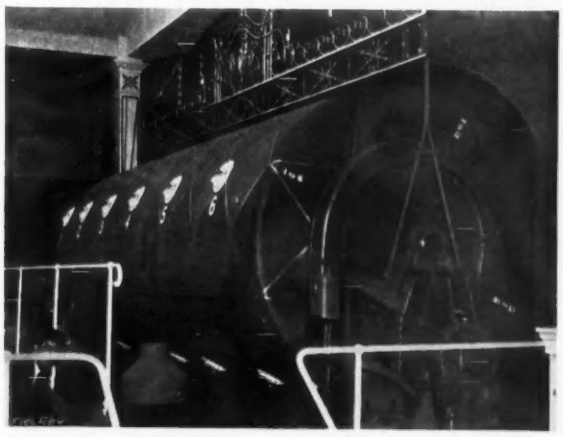
At Gennevilliers capital cost was more important and pulverised fuel was ruled out in the reconstruction of the original boilers. Each of the new boilers was designed for 240,000 lb. per hour economical rating and 300,000 lb. per hour emergency rating, the pressure being raised from 350 lb. at 700 deg. F., to 425 lb. at 750 deg. F. The combustion chamber walls were a combination of refractory and water cooling, whereas at Vitry (South) completely water-cooled walls were adopted. The efficiency of the boilers at Gennevilliers was slightly over 85 per cent. with a CO_2 content of 14 per cent. and a temperature to the stack of 290 deg. F.

Mr. A. L. Lunn mentioned a great improvement in the life of the impellers of fans by the use of nickel steel. Another means of increasing their life was to put the arrestors on the suction side of the fan, because then the velocity of the gases to be handled would be lower. He looked forward to improvements in chain grate stokers by way of sealing the grates, a matter now receiving serious attention. The retort type of stoker would be the stoker of the future so far as large boilers were concerned.

Mr. W. S. Burge said that he found it difficult to see an economical case for pulverised fuel firing. He was convinced that the retort type of stoker would deal successfully with the large evaporations required. Indeed, it was within the range of practicability for such stokers to deal with 500,000 lb. per hour. With boilers above that size there seemed to be a large field for the development of pulverised fuel for the purpose of superheating by reason of the possibilities of automatic combustion control.

Mr. W. J. Townley considered that the retort type of stoker had great possibilities. Unfortunately in this connection we had suffered from following American practice too closely. The first such stokers used here were much too short for our fuel and the results were unsatisfactory, but with modifications to suit our conditions it was proving a very serious competitor of pulverised fuel firing.

The author had time only for a brief reply. He still maintained his preference for the central pulverised fuel system as distinct from the unit system, because of the great advantage of a reservoir of pulverised fuel to draw upon. With regard to emissions from chimneys, he could not go into details as he was a member of the Chimney Emissions Committee of the Electricity Commission, but if the recommendations of that Committee, when made, were taken full advantage of, it should be possible to soot-blow any boiler without any emissions.



The topic of the week: The drum in which the Irish sweepstake tickets are mixed employs G.E.C. motors, starting and blowing apparatus

Bypath Automatic Telephony

THE construction and functioning of the apparatus used in the bypath system of automatic telephony are described in the paper which Messrs. J. W. Moffatt and K. B. Baldwin read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on March 11th.

The outstanding features of the system are: (1) the use of one type of switch throughout the system, the switch-bank of which can be divided into any number of groups and any number of outlets per group; (2) the use of common control circuits at each switching stage for controlling the setting of the conversational circuits; (3) the use of a temporary connection between the common circuit of one switching stage and that of the next.

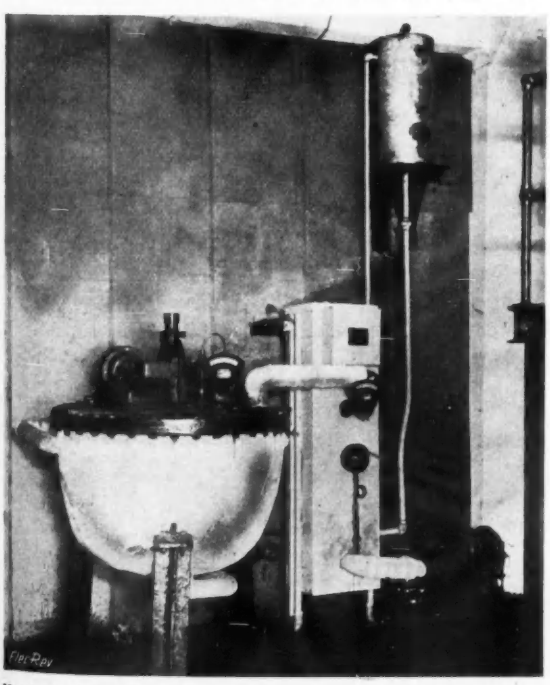
The switch used is of the self-driving uni-selector type. The bank is semicircular in shape and is built up of bank terminals insulated by phenol fibre and assembled between aluminium spacers, the whole being mounted in a die-cast aluminium frame.

The capacity of the bank is 51 outlets per level, distributed equally round an arc of 180 deg. This gives 50 outlets and one routine test-position when double-ended wipers are used, or 100 outlets and two routine test-positions when single-ended wipers are used. Banks having 6, 8, or 10 levels are employed in the system.

A notable feature of the switch is the rapidity and ease with which the mechanism can be jacked in and out of the bank, being secured by one thumb-screw. All mechanisms and banks are interchangeable. A high efficiency is obtained in switch repairs owing to the facility of bench adjustment. This "Standard" system is to be tried in London exchanges.

International Lighting Agreements

MR. C. C. PATERSON chose as his subject "Some Thoughts on the International Illumination Congress (September, 1931)" for a lecture delivered at the inaugural meeting on March 10th of a branch, the first provincial one, in Manchester of the ILLUMINATING ENGINEERING SOCIETY.



Kestner electrically heated chemical plant. (*See page* 420.)

He said that the travelling by coach and train, and visits to places of interest, afforded ideal opportunities for the Congress delegates to exchange views and to establish understandings. By the time they reached Cambridge for the plenary session there was about them such a spell of harmony and goodwill that agreements were reached which one had hardly expected possible. The world had just begun to slip rapidly downhill, and our visitors wondered to what sort of disorganised country they were coming.

The floodlighting display, which had been so carefully planned, succeeded beyond the widest expectations. At one stroke all fears were dispersed, the visitors saw that the rumours were false, and the Congress secured such publicity as no Congress had ever had before. All delegates returned to their homes in Europe as enthusiastic missionaries of the gospel of goodwill towards Great Britain; that alone was worth something. The emergency found illuminating engineers ready to work as a team.

Discussions and Decisions

Undoubtedly the one subject which attracted most interest at both the 1928 and the 1931 meetings was the broad question of applied lighting practice. In this domain the commercial and practical results of the scientific labours of the previous years were becoming apparent. It was a subject which could hardly receive too much attention, for unless there was an informed public to serve efforts towards better lighting would be largely sterile. The appraisement of buildings for daylight had been brought to a practical basis, and a uniform international standard was established for all time. The test for interiors which enabled one to judge whether they were inadequate for work under daylight conditions had been clearly defined, so that architects had a definite "yard stick" which would establish a figure of merit for interiors.

With photoelectric methods an accuracy of 1½ per cent. was easily obtainable in commercial photometry, and with speed in working. The constancy of commercial lamps themselves was hardly greater than this, but the advance was not merely measured by that figure of accuracy. The photoelectric method could be arranged for great accuracy over a con-

siderable range of colour, so that one setting by one observer now sufficed.

Before long every city which took its street lighting seriously would require its installations to be maintained within a certain definite limit of their rated values. Such requirements would have to be determined systematically by street measurements. Hence the vital importance of developing accurate methods.

At Cambridge, also, a working foundation was agreed to by all countries, which would ensure for all time a uniform system of light signals for night flying throughout Europe.

Another problem which had baffled the illuminating engineer had been to devise satisfactory tests for proving the effectiveness for practical purposes of diffusing glassware. Again, in this matter, this country had taken a leading share in reducing the subject to scientific and commercial order.

Investigations had enabled a mental picture to be formed of what went on inside a piece of opal glass and made it possible to predict the absorption, transmission, reflection and diffusion characteristics of any particular type of glass.

The effect of these developments on the quality of opal glasses obtainable at the present time could be judged from some performance figures. A small good electric lamp bulb might have only 8 or 9 per cent. greater absorption than a clear glass bulb, although there was sufficient scattering to obscure completely the image of the filament. In larger units of the totally enclosed diffusing type absorption would be of the order of 12-13 per cent., although the effective brightness of the source had been reduced from 3,500 to under 5 candles per sq. in. Many of them were familiar with opal glasses with more than 30 per cent. absorption.

One more direction in which great progress was made was in the art of colorimetry. There had hitherto been no standard method of measuring and expressing colour. It was a great triumph to achieve agreement, for the protagonists held their respective views as strongly and as honestly as any religious devotee his dogmas—with perhaps the difference that they *wanted* to agree.

Clearing Large Network Faults

THE features of large networks which are important in the design of selective protective systems are discussed in the paper which Messrs. R. O. Kapp and C. G. Carrothers read at the INSTITUTION OF ELECTRICAL ENGINEERS on March 17th.

The characteristics of distance protective relays are considered, and it is shown that nearly all the causes which lead to inaccuracy in their operation are due to the network and not to the relays. The conditions governing the minimum safe clearance times and minimum length of line that can be protected are discussed.

An analysis is given of the magnitude and distribution, between earth and the conductors, of earth fault currents on systems with multiple earthing of the neutral point, and the sources of error resulting from this distribution and means of compensating for this error are dealt with.

The cheapness of distance protective systems justifies their employment wherever it is technically possible. This is not, however, equivalent to saying that they are by any means a perfect solution of the problem of selective protection, for the authors point out that the large number of indeterminate factors controlling fault currents limits the length of line that can be safely protected by such systems.

Even where the length of line section and magnitude of the fault currents are such as to make distance protection possible, the disadvantage of the time-delay in the clearance of faults remains.

Directional Relays

To avoid these drawbacks without too great an expenditure in pilot cables, systems have been developed during the last few years in which a different specific feature of a faulty section is made use of, namely, the fact that fault current is fed into such a section at one end and does not leave it at the other. On all these systems operation is effected by means of directional and overload relays, and means are required to compare the position of the directional relays at each end of the section.

Such means demand a channel of communication which may either be a separate pilot circuit or a channel provided by carrier current over the power lines. The fundamental idea underlying all such systems is by no means new. It was suggested by Dr. Garrard as long ago as 1908, but, like many fruitful ideas, it lay dormant for a long period.

Two methods of protection which depend on the employment of directional relays and an inexpensive auxiliary circuit are the "lock-in" and the "interlock" systems. A third, known as the "duplex," is described for the first time in detail by the authors.

The Duplex System

While the signals transmitted by other protective systems employing directional relays are stabilising impulses confined to the sound sections, the signals transmitted on the duplex system are tripping impulses and are, therefore, transmitted over the channel of communication on the faulty section. This more direct method makes it possible to obtain instantaneous clearance, as with balanced pilot protective systems, whereas those systems employing a stabilising impulse have to introduce a time-delay of sufficient length to ensure that the stabilising impulse may have taken effect before the tripping relays are allowed to operate.

One pilot circuit only is employed, and it is identical with that employed for duplex telegraphy, where telegraph signals are sent in opposite directions over the same circuit at the same time without interfering with each other.

The difficulty in the design of protective systems introduced by the distortion of the vector diagram during a fault are explained, and it is suggested that these difficulties may be overcome if the distortion itself is used for relay operation, as may be done by employing negative and zero phase-sequence components.

How the Yoker Station has been Improved

SINCE work was started four years ago under the Central Scotland electricity scheme, an important programme of extension and reconstruction has been carried out at the Clyde Valley Electrical Power Co.'s Yoker power station in order to improve its general efficiency. The work was described, with many illustrations, in a paper read before a meeting of the Scottish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS in Glasgow on March 8th by Mr. Norman C. Bridge (Strain & Robertson), consulting engineer to the company.

During the period in question the frequency of the station has been changed over entirely from 25 cycles to 50 cycles, and Paisley, Greenock, and Kilmarnock are now supplied from this point through the new grid transmission lines. Amongst other developments that have been carried through, a large new switch-house has been provided, and a new generator house containing two main modern generating sets.

New boilers have also been provided, and the boiler plant installed some twelve years ago has been modernised throughout to give the same degree of efficiency as the new plant. The most drastic change in this connection was the complete replacement of the original mechanical stokers by a modern type and the lowering by eight feet of the whole firing floor of the boiler house in order to give more adequate furnace height under the boilers, which is essential for efficient and smokeless combustion.

The circulating water system for the generating sets has been largely rearranged in order to provide for the further development of the station at a later date, and the old main switchboards have been reconstructed for further service as feeder boards.

The whole of this work is just approaching completion, and it is expected, as a result, that the coal consumption of the station will very shortly be reduced from the "pre-grid" figure of 2.0 lb. of coal per kWh generated to about 1.4 lb., a figure which is well below the average for the country, and approaches that of some of the more recent stations.

Electrically Heated Chemical Plant

IN the ELECTRICAL REVIEW of November 7th, 1930, there appeared a description of an oil circulating heating system for chemical processes operated by electricity. The Kestner Evaporator and Engineering Co., Ltd., a British firm which has supplied installations comprising a patent oil circulation heating system with electrically heated absorber, has recently entered into an agreement with the National Electric Heating Corporation of America for the use of the latter's various patents on electrical heating, and offers a wide range of plant to suit varying chemical processes.

The illustration on page 419 shows a typical plant comprising a patent oil circulating heating system with electrically heated absorber for heating a jacketed vessel, the whole occupying very little floor space.

The company also makes an electrically operated plant employing a medium which is claimed to give temperatures up to 750 deg. F. as against 600 deg. F., the maximum obtainable with the oil circulation. At this higher temperature, the pressures involved are only of the order of 150 lb. per sq. in., so that the system is suitable for heating autoclaves and reaction vessels, melting gums, &c., where direct heating was formerly necessary, with its disadvantages of low efficiency, high temperature drops and uneven heating.

Other types of electrically heated plant are available where the material can be heated to 1,000 deg. F., and stills for fatty acids, &c., for example, can be operated continuously with a contact time of only one or two minutes. In this, and similar types of plant, the container resistance method of heating is employed, one of the essential features of which is the high rate of heat transfer and close automatic temperature control.

In many operations, the cost of heating is only a relatively small part of the total cost of the product, and the saving of labour and materials, the increase in rate of production and the better product soon repay any slight additional cost. Where the rate for electricity is low, the cost of the electrical heating system, with an efficiency that is claimed to exceed 90 per cent., will often be lower on a fuel basis than with other methods.

Correspondence

Correspondents should forward their communications as early as possible. No letters can be published unless we have the writer's name and address in our possession

Repulsion-start Motors

Mr. Huggins's expert article in the ELECTRICAL REVIEW of March 11th rendered some practical help in a case which seems worth recounting.

Six months ago a 1½-b.h.p. pump motor, after operating satisfactorily for two years, developed insufficient starting torque and I was unable to correct this. During this week-end I turned out of our scrap box the brushes originally supplied with the motor, and found that they were of a higher resistance grade than those which replaced them. The old brushes were still of workable length, and on refitting them the motor immediately regained its high starting torque, the comparative figures being 2.65/3.8 times full-load torque as against 1.3/2.7. The motor has 32 rotor slots and 64 commutator segments.

The start of the trouble evidently coincided with the renewal of the brushes. Thus brush quality is shown to be a factor which may be of the greatest importance with this type of motor, but this fact does not appear to be sufficiently known, as none of the books or engineers I consulted gave the slightest hint that this could be the cause of the trouble.

March 13th, 1932. ELECTRICIAN.

Distribution the Main Task

In your report under this heading of my remarks at the Birmingham E.D.A. dinner, held on March 2nd, I regret to notice that the omission of a couple of words entirely alters the effect of certain figures quoted. As a mere illustration of the activities in extending distributing systems in the industrial areas, I made the following statement:—

> "In Manchester, during *each* of the last four years, more than a quarter of a million pounds has been spent on the purchase of cables for the extension of the underground system of mains, and during *each* of those four years, the net new connections to mains exceed 30,000 kilowatts."

The figures as you have them, therefore, have to be multiplied by four.

Similar activity has, to my knowledge, been shown in most of the undertakings in the North of England, and my sole purpose in quoting the Manchester figures was to emphasise that they were typical of the whole.

H. C. LAMB,
Chief Engineer and Manager.

Manchester, *March 12th*, 1932.

Co-operative Electrical Publicity

The decision arrived at in New York to reduce the activities of the Society for Electrical Development and to put the office in charge of a "care and maintenance party," as the Navy has it, seems at first sight to be a severe blow to the cause of co-operative propaganda.

The organisation of co-operative propaganda in the American electrical industry is, however, not concentrated in the S.E.D., as it is concentrated in our country in the British Electrical Development Association with its area committees and local circles.

In the United States the National Electric Light Association is the most powerful organisation of the industry and, while at one time its activities may have been largely concerned with technical matters, to-day it pays most attention to propaganda. Very great efforts are made by this Association to secure editorial publicity, while the chief activity of its commercial section is the encouragement of new developments. In fact the N.E.L.A. does a considerable part of the work which is done on this side by E.D.A.

The principal work of the Society for Electrical Development of recent years has been the fostering of local "Leagues"; these Leagues might be considered the equivalent of the E.D.A. circles, but the financial support received by them from all sections of the industry is very great, and in 1930, when I visited the country, the revenue of several of the Leagues was equal to the total revenue of the British Electrical Development Association. These funds are collected directly, and are not provided through the S.E.D.

The S.E.D. was the central authority, preparing plans of campaign for operation by the Leagues, and it appeared to be performing a very useful function and relieving each individual League of a great deal of work.

If the S.E.D. does not recommence operations, it would seem that co-operative propaganda in the electrical industry will still be carried on nationally by the N.E.L.A., and locally by the Leagues; in fact American papers just to hand indicate that the N.E.L.A. is already launching a new campaign.

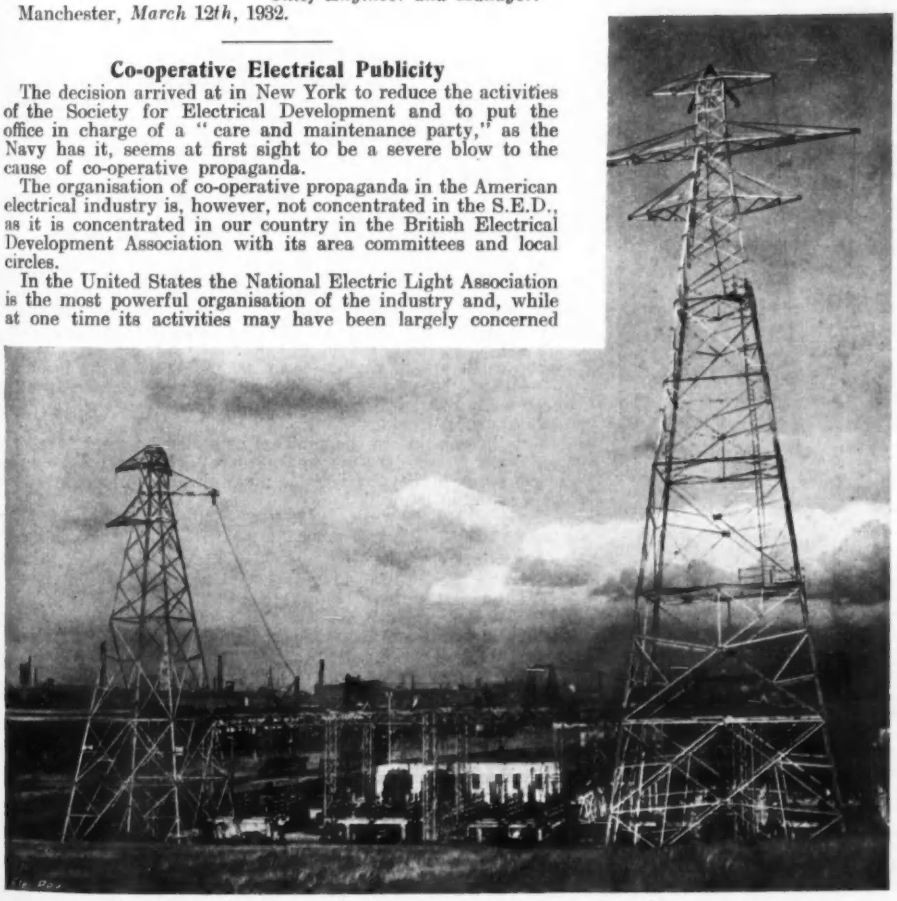
Turning to this country: in my view the necessity for co-operative propaganda on behalf of the electrical industry is greater at present than it ever was.

Chiswick, W.4, *March 11th*, 1932. W. A. VIGNOLES.

An Unreliable Profession

Many times have I been tempted into voicing an opinion on this subject, being ashamed of my own experiences, but on this occasion I feel that curbing my own pride and self-respect may be better for the junior members of the profession.

With family financial embarrassments at an early age, I went to work at fourteen. By a tedious process of self-sacrifice and many hours' overtime, sufficient money was saved to pay for further education. Bit by bit I made steady progress until I had been through the University with distinction to the D.Sc. standard and secured 75 per cent. of all available engineering prizes offered by the University; served four years' mechanical apprenticeship with a further two years' electrical apprenticeship with leading firms; spent valuable years with the forces during the War; held important industrial electrical executive posts; had three years in charge of a now selected power station; was responsible for the lay-out and design of super-power stations; was recognised and consulted as an authority on power station operation; had for several years superintended the design and installation of machinery at the rate of ¼ million sterling per annum; had travelled abroad and am *au fait* with Continental practice.



The grid crosses the Ribble. Transmission towers erected by the Enfield Cable Works, Ltd. The switchgear for the Ribble sub-station was supplied by Ferguson, Pailin, Ltd.

Then came the disillusionment. In the financial upheaval my firm suffered, and there came the parting of the ways. Not disheartened I commenced writing applications. Many interviews were secured by chief engineers, who, either from morbid curiosity or out of compassion, asked me round for a chat, but never a tangible offer resulted. I also applied for lower positions, but even here I was unsuccessful, as it was thought I was only anxious for the work as a stop-gap and would presently move on to higher realms—although I would have been glad of any work. In desperation the number of applications gradually increased to 21 per week, until I had thoroughly combed the industry — electrical undertakings and manufacturers alike.

Having satisfied myself that the trade had no

further room for a man of integrity, initiative, and understanding, there was only one alternative—to cut my losses and clear out. I reasoned that if I could fight my way up in one industry from the bottom rung, then I had still sufficient grit left to do it again in another sphere. Degrees and letters were erased from my name and I am now plain Mr. ———, living by my wits.

When will leaders of the industry addressing Youth tell them the true facts? I wish it had been done in my youth. It would have been kinder. NIL DESPERANDUM.

March 14th, 1932.

I have read with interest the letter of "Dilemma" in your current issue. The well qualified engineer whom he mentions appears to be having the same unfortunate experience that I have been undergoing for the past 2½ years.

Before the War I served my time with one of our greatest electrical engineering firms, attending night school at the same time. I was for over four years in the War and afterwards obtained my degree at one of our Universities, and spent a further two years with the same great firm. I then obtained an appointment in India and served there until my agreement expired after five years.

I have excellent testimonials covering all my service, and I am an associate member of the Institution. My age is 34. Since the middle of 1929 I have been haunting the public libraries and have applied for dozens of appointments, most of which I seemed to be admirably suited for; I have been to the Officers' Association and the employment section of the Institution, but not only have I been unsuccessful, but I have only had about two replies to my letters. I cannot even draw the "dole," and as the pay of even a qualified electrical engineer is never very high, the savings I had accumulated have now nearly gone.

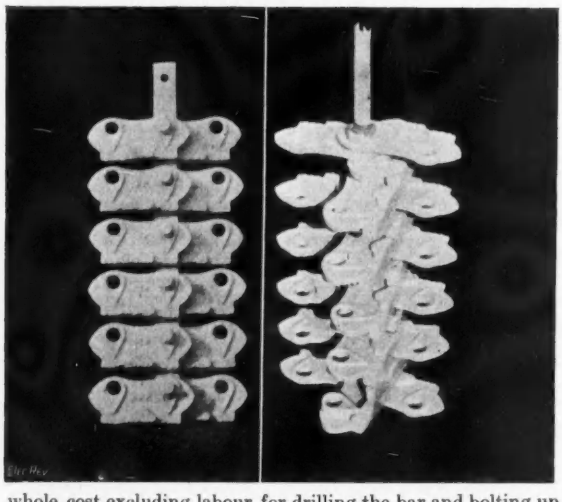
Had I gone in for one of the other professions named by "Dilemma," and spent less money, time, and energy on my education, I should no doubt now be in a comfortable position.

Is there nobody who can come forward and give a helping hand to people who are situated in the same position as myself?

March 14th, 1932. UNLUCKY ONE.

Cheap Earth Plates

I enclose photographs (reproduced below) showing earth plates made up from old chain grate stoker links, which being classed as "burnt" cast iron fetch practically nothing as scrap. One pattern (left) is made up by bolting the links to a 2 in. by ¼ in. iron bar by means of 2½ in. by ⅜ in. bolts, the



whole cost excluding labour for drilling the bar and bolting up, being about 2s. 6d.

The other pattern (right) is made up by threading the links over a long ⅜ in. iron bolt 24 in. long with lock nuts at the top end. The plates can, of course, be made up to any suitable size according to the purpose for which they are required and the conductivity of the soil they are buried in. They have been whitewashed to enable them to be photographed.

ARCH. J. HOWARD,

Taunton, *March 11th*, 1932. *Borough Electrical Engineer.*

Trams *versus* 'Buses

It is to be hoped that the letter from Mr. Baggs on "Trams *versus* Buses" in your issue of March 4th will touch the conscience of the majority of electrical engineers. He is right in his suspicion that "the fact that many electrical engineers are motorists makes them lukewarm in the matter," although, logically speaking, familiarity with motoring ought to give electrical engineers a bias *against* petrol traction.

Electrical engineers will spend hours discussing the chronic ailments of motor cars. They will exercise the most intricate ingenuity in trying to circumvent the hopeless obsolescence of their cars after a year of so of carefully-nursed life. Yet they seem to jump at the chance of substituting, for a thoroughly reliable, efficient and long-lived electrically-propelled vehicle, one that is, from an engineering point of view, incomparably less satisfactory.

The light-hearted way in which electrical people have thrown over tramways and presented their traffic to the petrol people is really deplorable. They have encouraged the myth that "tramways are obsolete," although they must know that there is nothing to touch the tramway for handling heavy street traffic economically. A method of transport that carries nearly 4,400,000,000 passengers a year deserves something better than such a summary dismissal.

Everyone will admit, of course, that some tramways were installed where the traffic did not justify the capital expenditure, or at least the cost of track renewals under present conditions. But in these cases there is no need to fly to petrol.

Why does Mr. Baggs ignore the trolley omnibus? Is he influenced, as many electrical engineers have been, by the disappointing results of early trials with trolley vehicles built on heavy tramcar lines? Is he unaware, as so many electrical engineers seem to be, of the immense advance in trolley omnibus design and of the satisfactary results attained in many districts where the traffic conditions and cost of current are suitable to the trolley omnibus?

The electrical industry does not seem to have the faintest idea of the treasure it possesses in the trolley omnibus. No other vehicle—except, in certain respects, the battery vehicle—comes within a hundred miles of it for quietness, smoothness, and swiftness of acceleration, comfort, absence of vibration, safety, reliability, economy, and long life.

We in the electrical industry, in short, hold the ideal solution for traffic between a six-minute and a fifteen-minute headway. But we are sacrificing both the credit we ought to enjoy and the cash value of a steady traction load with a good load factor.

Missionaries who go abroad to convert the heathen are often told that their services are more urgently required at home. A similar situation seems to exist with the electrical gospel.

March 14th, 1932. PROTONIUS.

The Distribution Problem

I am much obliged to Mr. Kennedy for his reply in your last week's issue to my letter which appeared the week previously, and I think he will allow me a rejoinder.

It is reasonable to assume that the local authorities and companies which raised the capital mentioned by Mr. Kennedy did so with the knowledge that it could be employed with immediately remunerative results, that is to say, the area to be provided with distribution network was already sufficiently populated to ensure a consumption of energy which made the enterprise a sound business proposition at the undertakings' current tariff rates for supply.

I agree that when the co-ordination of generation is complete it will not be necessary in future to raise large sums for generation, but the interest and sinking fund charges on the huge amount of capital that will have been raised for co-ordination must be one of the considerations brought into account when determining the terms for supply to be imposed upon the distribution undertakings. The latter will also be obliged to have regard to similar charges on the capital raised and required for distribution purposes.

The essence of the problem appears to be whether the rural areas can now provide a demand for electrical energy upon terms which will not only be acceptable to the consumers but will also yield an adequate return on all the costs involved in accelerating and extending the supply.

Although the average price per kWh must vary inversely with the sales, those responsible for authorising the capital expenditure must marshal the facts from which they can state with reasonable accuracy what the tariff rates will be at the outset. It is not sufficient to say what the rate ought to be when consumption reaches from 200 to 500 kWh per head of population, because a high rate at the commencement will necessarily restrict demand and throw heavy losses on the distribution undertakings.

Let the solution to the problem as stated be demonstrated, and then it will be time to consider "whether the present organisation of distribution . . . must give place to some other kind of organisation."

London, E.C.1, *March 12th*, 1932. J. LESSER.

I was interested in Mr. J. M. Kennedy's letter in your issue of March 11th, but I cannot see how the grid will help forward the distribution in rural areas.

When the grid scheme was put forward the then cost of generation in power stations containing much old inefficient plant was compared with the *estimated* cost of generation in superstations with all new modern plant. The only fair comparison is to compare the all-in generation cost of a local power station equipped with up-to-date plant with the cost of grid current at the station busbars ready for distributing.

If the money spent on the grid had been spent on equipping existing power stations with up-to-date plant and extending the distribution systems, there would have been a better return.

Electricity supply in rural areas is being retarded by wayleave difficulties and the unnecessarily stringent requirements of the Post Office, railway companies, Electricity Commissioners, &c. If the supply authorities had been given a free hand, with full powers, the rural districts would have been covered with a network of distributing mains many years ago.

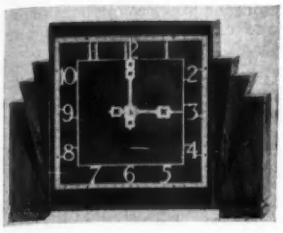
March 14th, 1932. SUPPLY ENGINEER.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Synchronous Clocks

The "Synchronomains" clock, recently introduced by the SYNCHRONOME CO., LTD., 32 and 34, Clerkenwell Road, E.C.1, is entirely of British design and manufacture, and consists of a drum movement of standard size mounted in a handsome moulded Bakelite case finished either in mahogany, walnut or black. It is of the low-speed synchronous type, with a motor, running at 200 r.p.m., from which two stages of worm gearing provide a silent speed reduction to the hands.

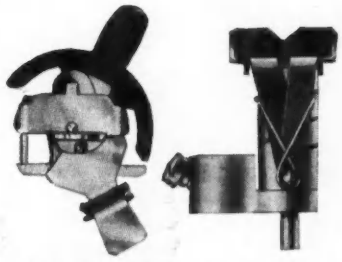


A "Synchronomains" clock

A salient feature of the motor is its very low loading—0.5 W. In practice the movement will operate hands for dials up to 2 ft. 6 in. in diameter by virtue of the very efficient lay-out of the mechanism, particularly in regard to the electrical elements. The clock possesses all the advantages of the non-self-starting type, in that it cannot restart, after a current interruption, until the hands are set to the correct time, thus avoiding the possibility of its ever indicating the wrong time while running. The apparatus is available in a large variety of designs, including those for mantelshelf and wall use, in addition to grandfather types.

An "Anti-flash" Switch Plug

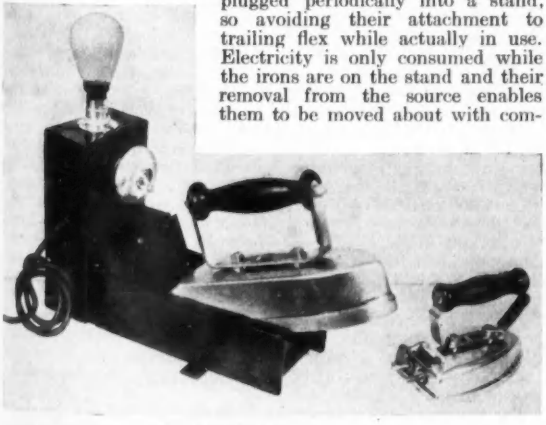
M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, has introduced a new range of surface switch plugs of particularly small dimensions, embodying some special safety features. The "anti-flash" device embodied in these switch plugs permits the plug on a live circuit to be withdrawn without an arc forming, and shutters completely cover the live sockets. The switch embodied is of the quick make and quick break type, with a heavily reinforced dolly. The dimensions are very small, and the whole combination is built on attractive lines. The price is the same as the ordinary non-interlocking types with open sockets, and the switches are made for 5- and 15-A B.S.S. in two- and three-pin.



The M.K. switch plug: anti-flash device and switch movement

A "Wireless" Iron

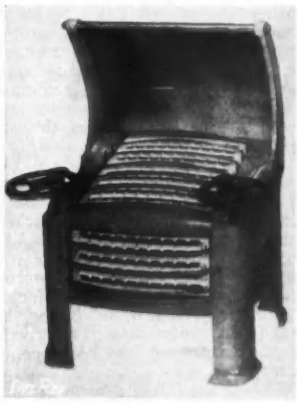
Safety first appears to have been the idea which prompted the design of the registered patent appliance which is marketed by the DONALDSON WIRELESS ELECTRIC IRON CO., 19, Crighton Place, Edinburgh, for heating flat irons. Heat storage is the essential feature of the system, for which the irons are specially designed. Instead of being continuously heated the irons are plugged periodically into a stand, so avoiding their attachment to trailing flex while actually in use. Electricity is only consumed while the irons are on the stand and their removal from the source enables them to be moved about with complete freedom. Two models of stand are available: a domestic one and a larger one incorporating a switch and indicating lamp for the heavier types of iron used by tailors, dressmakers, and for commercial laundry work. The iron elements are said to be easily replaceable.



A plugging-in iron

A Simple and Attractive Fire

The "Super-Trivet" fire recently introduced by MESSRS. H. G. MOSELEY & CO., LTD., Eddo Works, Hospital Street, Birmingham, is an example of simplicity combined with attractiveness. The cast-iron frame is in three pieces, a front which is secured to the sides by two screws. A sheet-iron back secures the sides at the back, while a through bolt at the top holds the stainless-steel reflector. A simple insulated iron bar serves for the switch connections, &c.



"Super-trivet" fire

Although the makers do not recommend such a practice, a kettle can actually be boiled with the trivets swung over the elements. The 2-kW model has two bars at the top, and the 3-kW size has an extra bar in front. There are several finishes available in vitreous enamel, including one in "marble." We were also impressed by the same fire in stainless aluminium.

Spanners, Wrenches, Etc.

A spanner recently introduced by "FASTNUT," 62, Finsbury Pavement, E.C.2, has a three-point contact and will fit and ratchet on six or more sizes of nuts. It will not slip or gape when screwing up a nut, or damage the corners of the nut.

With a three-point contact and teeth on the footprint principle, the "Fastfit" wrench will take round, square and hexagonal nuts, and fit and ratchet on nuts up to 1 3/16 in. across the flats. It will also fit on any pipe from ¼ to ¾ in.

By virtue of downward and inward projecting teeth on the inside periphery of "Fastnut" washers, security against vibration is obtained. They are available in sizes from ½ in. to 2¼ in.

The "Autoway" Hand Dryer

Machines for use in toilet rooms which produce a current of warm air electrically for drying one's hands and even face in a few seconds are not new in principle, but the machine made by the AUTOWAY CO., 13, Wellington Street, Glasgow, is a home product.

This hygienic hand dryer is available in two attractive forms, namely, a cabinet for mounting on a wall and also a pedestal model. Both types are foot-pedal operated and thus consume electricity only so long as they are actually functioning. When used in public buildings they can be installed as a free service, or a penny-in-the-slot arrangement can be incorporated if desired.

Wall and pedestal type hand dryers

Electrical Production in 1930–31

The B.E.A.M.A. report

IN reviewing events during the year ended September, 1931, the Council of the British Electrical and Allied Manufacturers' Association says that the depression of 1930 was followed by a severe fall in the general price level, certain primary products registering the lowest prices for fifty years. Every country and practically every industry still feels the full force of the crisis.

The value of orders placed by the Central Electricity Board amounted to £3,000,000, as compared with £11,000,000 in the preceding year; and as the national grid is now practically complete, new markets must be found and can only be found by more rapid progress with the domestic load and by the development of export trade. Switchgear orders were well maintained until the closing months of the year; but, in generating plant, there was a progressive decline both on home and export account throughout the whole year.

Converting plant orders, especially reconstruction contracts, showed a small increase over last year. Turbine business for the home market slumped heavily, and turbo-alternators likewise declined. Transformer contracts were not so seriously affected, but prices were distinctly unsatisfactory. The manufacturers of smaller apparatus fared better, largely because electricity supply recorded a 5 per cent. increase in the total generation of current.

Despite the fall in manufacturing activity, the average number of workpeople employed in electrical engineering, wires, cables and lamp manufacture, and electric wiring, increased from approximately 180,000 in 1930 to 191,000 in 1931, while, in the number of insured workpeople, an increase over 1930 of more than 2 per cent. was recorded for electrical engineering, compared with 6 per cent. in cables and lamp manufacture and 22 per cent. in wiring and contracting. This last increase is, of course, exceptional, the principal cause of it being the progress made in domestic electrification. There was a decline of 33⅓ per cent. in export orders.

[*Russell & Sons.*

The Rt. Hon. the Earl of Derby, K.G.
(*President of the B.E.A.M.A.*)

Anti-dumping Action

Foreign manufacturers increased their imports in the last quarter of the year to such an extent that summary measures (the Abnormal Importations Act) had to be taken by the Government to deal with the threat to our industries and to our balance of trade. The Council successfully applied for Orders, imposing duties on the electrical goods and apparatus named in an annexe to the report.

It is difficult at the moment to make any forecast as to a trade revival, but, apart from financial difficulties, it is probable that 1932 will be a year of gradually improving trade. Even now, there are signs that the purchasing power of primary producing countries is rising.

At home, the full effect of tariff legislation will not be felt for some time, but the anticipation of its beneficial effect has created a new spirit of optimism.

During the autumn the Council appointed a Tariff Committee to consider what should be the appropriate rates of import duty upon the various manufactures of B.E.A.M.A. members. In the majority of cases the duties suggested were on the specific basis, but where the value of the goods per unit of weight varied considerably, the *ad valorem* basis was adopted. In some cases, both systems were combined and, in others, used as alternative.

Transport and Railway Electrification

In the London Passenger Transport Bill it was proposed to confer upon the London Passenger Transport Board, a statutory authority, power to "*manufacture* . . . appliances and apparatus," which would, of course, include electrical equipment.

The B.E.A.M.A., in co-operation with other trade associations, succeeded in resisting that, and the clause was amended by the Joint Committee, depriving the Board of such power.

The movement towards railway electrification received a stimulus by the statement of the directors of the L.M.S. Railway that they had given careful consideration to the Main Line Electrification Committee's Report, and that they had informed the Minister of Transport that the railway companies would, if desired, formulate suggestions for the completion of a substantial instalment of a comprehensive system within the next ten years; but that they would like, first of all, to know the nature and degree of assistance, if any, to be given by the Government.

The Council hopes that the reply of the Government will not be unduly delayed and that it will be sufficiently encouraging to permit of the companies proceeding with the formulation of their suggestions.

With reference to the issue of the B.E.A.M.A. trade mark, the clearing up of legal questions, between the Comptroller and the solicitor, has delayed progress.

The Meter Section's Marking Order went into effect on September 29th last year. Fiscal policy, in the opinion of the parties concerned, has made other applications less immediately necessary, and, with one exception, they have been postponed for the present.

Mr. Siddeley's Post

The Council proceeds to deal with the Buenos Aires Exhibition, and the reports thereon, which were circulated to members in June and July. A special committee sat, and as a result Mr. Siddeley is proceeding to the Argentine as already fully announced in these pages. Mr. Siddeley, through his organisation, will augment, without overlapping, the efforts made through existing channels by members. He will act as a trade ambassador, and maintain the necessary prestige for the British electrical industry as a whole, keeping close contact with all important interests. All the members of the association were invited to participate in this undertaking and to give it their support. The D.O.T., which has promised its full support towards making the enterprise a complete and conspicuous success, has given financial assistance in the form of a substantial monetary grant.

A summary of the Faraday Centenary Celebrations and the Albert Hall Exhibition is given.

Contract Conditions

Little comment is made upon conditions of contract. With regard to the I.E.E. Model Conditions "A": Clause 25, negotiations between the Revising Committee and the I.M.E.A.-B.E.A.M.A. Joint Committee, for increasing and expediting the payment of the instalments of purchase price were continued, and, after protracted discussion, a draft clause embodying the desired terms was agreed, and will shortly be submitted to the Institution.

B.E.A.M.A. Conditions "A" and "B" have also been under discussion and proposals have been accepted by the Council, which has also considered the regularisation of hire-purchase and deferred payment business systems.

There is again a slight but steady decrease in the number of overseas students in members' Works. It dropped from 218 in 1930 to 195 in 1931. India still continues easily to maintain first place (an adequate reply to complaints by Indian students of neglect of their interests).

The China Indemnity (Application) Act, 1931, created a Chinese Government purchasing commission, with purchasing powers of several millions for goods in this country. It also voted to the Universities China Committee here £200,000, to be spent on various educational objects, mainly for the benefit of Chinese students; but whether any portion of that sum will be expended on practical training in works is still in doubt. The matter is in the hands of the F.B.I., whose China Committee is presided over by Lieut.-Col. Morcom, C.B.E., past-chairman B.E.A.M.A.

The report contains a brief reference to the importance of the Electrical Research Association and commends it to the attention of members.

After dealing with the Association's standardisation activities, the report refers to the establishment of the Mines Department's testing station at Buxton. In view of the depressed state of the coal-mining industry, it is hoped that the increased cost of electrical apparatus, due to the stiffening up of requirements, will not unduly retard the process of bringing mining machinery into that condition of efficiency which is one of the essentials in the restoration of the industry.

In conversations with H.M. Inspector of Factories the Switchgear Technical Committee put forward a suggested table of clearance distances between circuits and between live conductors and earth. Agreement could have been reached if the Committee's interpretation of the term "section" had been accepted by H.M. Inspector. The question is whether every neighbouring circuit which contains an isolating switch or a group of allied circuits, controlled by a circuit breaker, constitutes a "section." If the former interpretation is to be officially adopted the cost of outdoor sub-stations will be prohibitive in many cases.

The Standardisation Committee, having ascertained the views of manufacturers, is not satisfied that the time is ripe for complete standardisation of motors in Great Britain, but thinks that a beginning might be made by reducing the large number of dimensions which now exist for corresponding parts of different makes of motors.

The terminal marking proposals of the Special Committee have met with general acceptance, and, so far as electrical

machinery, transformers, switch- and control-gear are concerned, will be gradually adopted as circumstances permit.

The third International Steam Tables Conference will be held in the United States next September. Investigation into the subject has continued in the four participating countries and a very complete report has been published embodying some satisfactory work which has been carried out by the British investigators.

The Traffic Committee has been able to secure amendments and additions to the General Railway Classification which will be of advantage to members. This Committee considers that the railway companies should not rely on the imposition of additional legislative restrictions on road hauliers to reduce the competition between rail and road transport, but that they should adopt a less rigid attitude with regard to rates charged for merchandise which is capable of being carried by road.

Notwithstanding strong representations made by B.E.A.M.A. and other delegates the shipping conferences are unable to give any relief during the present depressed state of the shipping industry.

The Economic and Statistical Department was actively engaged during the year.

The Export Committee after considering the situation arising out of the abandonment of the gold standard recommended to members that all quotations should be made in sterling and that they should be accompanied by a statement that they were subject to confirmation or revision prior to acceptance. The Committee considered afresh the constitution of the India Overseas Committee, and made suitable suggestions to that Committee.

The report refers at length to the activities of the Electrical Development Association.

During the past year the I.M.E.A.-B.E.A.M.A. Joint Committee devoted time to the consideration of a proposal for a reduction in the number of sizes of a.c. house-service meters, but a settlement has not yet been reached.

The dispute as to the commencement and termination of the guarantee of electric cooking apparatus purchased by municipal authorities but not put into use on consumers' premises until some time after the date of purchase has been settled to the satisfaction of all parties.

During the year Sir William Bragg, O.M., F.R.S., accepted office as vice-president; Mr. P. J. Pybus tendered his resignation as a vice-president on his taking office as Minister of Transport. Sir Philip Nash tendered his resignation as a member of the Council, on his retirement from the Metropolitan-Vickers Electrical Co., Ltd., and his seat was filled by Mr. P. S. Turner.

Lieut.-Col. Morcom, C.B.E. (past-chairman) was appointed a member of the British Economic Mission to the Far East whose report was issued during the year.

A Survey of Electrical Manufacturing

IN a recent issue of the *Board of Trade Journal* are published the results on the fourth Census of Production relating to the electrical engineering trades. The year covered is 1930, and comparison is made with the figures provided by the previous census taken in 1924.

The table below provides an analysis of the production, exports, and retained imports under the principal classifications. The figures of production shown for 1924 cover all firms in the United Kingdom, including those which employed ten or fewer persons on the average in that year, while those of 1930 relate only to those firms in Great Britain employing more than ten persons.

At the 1924 census an output of electrical machinery and apparatus, etc., valued at £3,050,000, was returned on schedules for other trades, but corresponding information with regard to 1930 is not yet available. The inclusion of the output of Northern Ireland in the 1924 figures does not seriously disturb comparisons. The figures of exports and imports relate to the United Kingdom in both cases, and for 1924 take into account the returns on schedules for trades other than electrical.

	Production.		Exports.		Retained Imports.	
	1924.	1930.	1924.	1930.	1924.	1930.
	Thous. £.	Thous. £.	Thous. £.	Thous. £.	Thous. £.	Thous. £.
Generators	2,100	1,910*	1,253	1,179	82	36
Motors (other than railway or tramway)	4,050	3,779	1,069	1,095	200	302
Convertors and transformers	2,610	2,785	699	922	87	41
Control and switchgear	3,525	5,913	945	1,950	25	38
Switchboards (not telegraph or telephone)	1,665	1,543*	91	89	—	1
Other electrical machinery	2,980	1,259	Figures not available			
Parts of electrical machinery, sold separately	not separately recorded	1,275	Figures not available			
Electric carbons	564	533	27	13	117	190
Electric lamps and parts	2,468	2,642	353	610	220	583
Telegraph apparatus	274	407	2,659	2,402	817	980
Telephone apparatus	3,648	5,544				
Radio apparatus (excluding valves)	4,593	6,324				
Radio valves	1,258	1,102*	Figures not available			
Electric wires and cables	18,580	19,112	4,477	4,546	570	957
Conduits and fittings	430	881	Figures not available			
Batteries	728	2,589	124	163	316	687
Accumulators and parts	3,524	3,160	617	728	56	57
Other electrical apparatus and parts	8,633	11,069	Figures not available			
Total	61,630	71,827	Figures not available			

* Understated owing to outstanding returns.

The estimated value of the work in progress at the end of 1930 was returned as £9,779,000, and that of the work in progress at the beginning of the year as £10,099,000. Electrical contract and other work carried out in Great Britain during 1930 is given as £6,108,000, as compared with £4,625,000 in 1924, but actually the former figure is understated since firms engaged solely in contract, etc., work were assigned at the census taken in 1930, to the building and contracting trades.

Generally speaking, the output of electrical engineering does not lend itself to satisfactory quantitative comparison, but considering the fall in the level of prices between 1924 to 1930, it would seem that the output as a whole was substantially greater in volume in 1930.

Cost of materials used increased from £35,735,000 in 1924 to £40,306,000 in 1930, and the amount paid for work given out to other firms from £247,000 to £3,311,000. The net output for 1930 was £39,447,000, as against £32,979,000, while the net output per person declined from £219 to £218. An increase from 150,610 to 180,820 in the average number of persons employed was recorded, and while the operative staff was greater in 1930 than in 1924 by 18 per cent., the administrative, etc., staff was 30 per cent. greater.

The outstanding feature of the comparison of the data relating to the power used in the factories concerned is the increased use in 1930 of electric motors driven by purchased electricity, and the marked decrease in both prime movers and electric generators in the works themselves. The actual capacities of the installed plant for 1924 and 1930 were respectively: Prime movers, 45,945 and 28,807 h.p.; electric generators, 30,415 and 18,372 h.p.; electric motors driven by electricity generated in own works, 47,966 and 22,167 h.p.; and electric motors driven by purchased electricity, 112,392 and 212,841 h.p. The total quantity of electricity used for all purposes in the factories was 204.2 million kWh, of which 185.1 million kWh was purchased.

It is encouraging to note that in such other industries as the tool, earthenware and linoleum trades electric power is also being used to a far greater extent.

Generation of Electricity in February

THE official returns rendered to the Electricity Commissioners show that 1,133 million kWh was generated by authorised undertakers in Great Britain during the month of February, 1932, as compared with the revised figure of 1,006 million kWh in the corresponding month of 1931, or an increase of 12.6 per cent.

During the first two months of 1932, up to the end of February, the total amount of electricity generated by authorised undertakers was 2,295 million kWh, as compared with the revised figure of 2,155 million kWh for the corresponding period of 1931, representing an increase of 6.5 per cent.

In the United States (according to the National Electric Light Association) 6,225 million kWh was generated during the four weeks ended February 27th, a decrease of 6.8 per cent. from the corresponding figure for February, 1931. Since the beginning of the year to that date 13,205 million kWh was generated, a decrease of 6.75 per cent. from the production for the first two months of 1931.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

British-made "Sadias"

Sadia, Ltd., 22, Newman Street, W., announces that arrangements have been made to manufacture Sadia automatic electric water heaters in England. The company, which was primarily an organisation for the sale and distribution of Swiss manufactures, has decided to go into voluntary liquidation. All creditors have been, or will be, paid in full. The British Sadia heaters will be manufactured by Aidas Electric, Ltd., of Aidas Works, St. Leonard's Road, Willesden, N.W.10. A notice to this effect issued by that company states that improvements in design and construction have been embodied in the new heater, while prices have been reduced.

Electrical Showrooms for Dumfries

Mr. A. E. Roots, engineer and manager of the Dumfries electricity undertaking, informs us that the Burgh Council at its meeting on February 4th resolved to erect show and demonstration rooms on a corner site at Loreburn Street and Newall Terrace, at a probable cost of £1,000.

The British Clock Manufacturers' Association

The principal British manufacturers of clocks both mechanical and electrical met recently to discuss and determine how best they could by joint action further develop the industry, and foster the interests of those concerned in it. As a result a new association under the title of "The British Clock Manufacturers' Association," was inaugurated, under the chairmanship of Mr. A. Gordon Smith. Any British manufacturer of clocks may obtain full particulars regarding membership from the secretary, Mr. P. J. Chaplin, 8, Staple Inn, W.C.1.

A Lift Manufacturing Development

Medway's Safety Lift Co., Ltd., which hitherto has been controlled by J. & E. Hall, Ltd., Dartford, has now become a department of Messrs. Hall's organisation, with the whole of the personnel formerly employed by the lift company. The change involves no more than a limited amount of internal reorganisation. In addition to lifts of all types, J. & E. Hall, Ltd., are now manufacturing escalators to the design of the Carl Flohr Company, of Berlin. Five of these have recently been installed at Messrs Bentall's new stores at Kingston-on-Thames, and another escalator order has been received from Messrs. Hammonds, of Hull.

New Australian Companies

Among companies recently registered in Australia are:—Row's Electric Patents, Ltd. (Sydney), with a capital of £5,000; and Federal Insulating Products, Ltd. (352, Collins Street, Melbourne), with a capital of £20,000.

Electrical Production in the United States

A further decline in the production of electrical equipment is indicated by statistics published in the February issue of the *Survey* of the National Electrical Manufacturers' Association (U.S.A.), relating to the output of certain of its members during November and December. For the two months mentioned orders for a.c. motors (1-200 h.p.) with control equipment amounted to $2,470,055, a decrease of $240,642 as compared with the preceding two months, while d.c. motors (1-200 h.p.) also fell from $725,657 to $602,501. Fractional h.p. motors at $2,443,280 were $515,017 lower. Outdoor power switching equipment showed some improvement, rising from $432,164 to $521,120, while indoor apparatus at $75,878 ($78,133) was steadier. Orders for electric furnaces increased from $67,153 to $70,203.

E.D.A. Lecture for Schoolboys

The first of a series of five weekly lectures on electricity was given last week, at the Scarborough High School for Boys. The lectures, under the auspices of the British Electrical Development Association, are entirely for young people. The Mayor of Scarborough presided on this occasion and was supported by Capt. A. W. Brown (Bradford), Yorkshire area of the E.D.A. The lecturer is Mr. C. W. Robson, B.Sc. (London), head of the Physics Department of the University College of Hull.

Russian Telegraph Apparatus Production

The Russian Government has commenced the erection of a factory at Kaluga for the manufacture of telegraph apparatus. This will be the first of its kind in Russia.

Cheaper Radio Valves

Reductions of from 1s. 6d. to 5s. in the prices of radio valves are announced by the British Radio Valve Manufacturers' Association. The new prices operate as from Monday last, and affect "Mazda," "Cossor," "Osram," "Marconi," "Mullard," "Six-Sixty," and certain types of "Philips" valves.

The Chicago Radio Show

The tenth annual Chicago Radio Show was held in January, all the available floor space being occupied. According to a Department of Overseas Trade report the majority of exhibits were those of completed receivers, and very few manufacturers of accessory apparatus were represented. All the sets on view conformed to a uniform type, combining a chassis and loudspeaker; not a single loudspeaker, apart from those embodied in the receivers themselves, was to be seen. Most of the sets were designed for mains operation and the more elaborate sets included gramophones.

British Electrical Exports

BELOW will be found a table showing British electrical imports and exports for February. An analysis of the electrical machinery exports discloses an increase of £45,908 compared with January, larger shipments to European countries (which rose from £78,902 to £112,097) being responsible for the major portion of the improvement. South and South-West Africa, taking goods to the value of £21,676, also slightly increased their purchases, as likewise did British India (£68,643), Australia (£25,303) and "other countries" (£48,635). Exports to Japan (£219) were practically negligible and there was a falling off in the shipments to South America (£17,578), New Zealand (£9,746) and Canada (£8,398). Compared with February, 1931, British India and Australia, with increases of £10,027 and £7,291 respectively, were the only sections of the market showing an advance; the most serious decreases were recorded in exports to South American countries (which fell from £58,117 to £17,578) and to Canada (from £24,981 to £8,398).

	EXPORTS.			IMPORTS.			RE-EXPORTS.		
	Electrical exports for Feb., 1932.	Inc. or dec. as compared with Jan., 1932.	Inc. or dec. as compared with Feb., 1931.	Electrical imports for Feb., 1932.	Inc. or dec. as compared with Jan., 1932.	Inc. or dec. as compared with Feb., 1931.	Electrical re-exports for Feb., 1932.	Inc. or dec. as compared with Jan., 1932.	Inc. or dec. as compared with Feb., 1931.
Insulated wires and cables	£108,785	+ £6,882	− £65,415	£60,592	+ £21,139	+ £2,871	£215	+ £155	− £1,007
Electric carbons	3,155	+ 2,320	+ 2,663	6,033	− 6,401	− 5,121	563	+ 424	+ 482
Arc lamps and searchlights	396	− 982	− 1,205	—	− 193	− 930	39	− 61	+ 39
Incandescent lamps	26,789	− 1,707	− 3,260	9,164	+ 1,167	− 15,972	472	− 240	+ 48
Other lighting apparatus	27,549	− 846	− 8,730	20,061	+ 4,158	− 19,858	1,024	− 188	− 177
Batteries and accumulators	37,757	− 18,092	− 12,467	17,326	+ 1,391	− 31,818	370	+ 39	− 59
Meters and instruments	27,847	+ 9,456	− 1,451	49,839	+ 13,443	+ 21,998	276	− 83	− 712
Unenumerated goods and apparatus	87,032	+ 9,395	− 29,089	84,031	+ 30,952	+ 4,217	2,883	− 1,507	− 5,116
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	12,399	+ 440	− 44,415	217	− 497	− 2,034	—	− 74	− 1,051
Submarine telegraph and telephone cables	5,343	+ 4,789	+ 2,467	—	—	—	—	—	—
Telegraph and telephone apparatus	154,155	+ 36,238	− 44,021	43,314	− 15,739	− 59,790	3,763	− 635	− 4,976
Electrical Machinery—									
Railway and tramway motors	9,557	+ 8,504	− 4,482	—	—	—	—	—	—
Other motors and generators	96,515	+ 37,469	− 48,620	—	—	—	—	—	—
Unenumerated electrical machinery	206,226	− 65	− 41,198	89,501	+ 2,070	− 20,306	11,860	+ 3,957	+ 1,245
Total	£803,505	+ £93,801	− £299,223	£380,078	+ £51,490	− £126,743	£21,465	+ £1,787	− £11,284
Decreases for the first two months of the year		Exports. £838,639			Imports. £357,695			Re-exports. £34,036	

The American public is attracted more by style than by quality, and even superior equipment cannot succeed if the form of its presentation is not fashionable at the moment. The majority of the sets on show were superheterodynes with up to ten valves. Two different systems of television displayed their respective advantages, those of the Western Television Corporation and the Sanabria Television Corporation. The latter appeared the more progressive and ambitious. In addition to a continuous theatre programme of televised subjects, their projection was carried out on a screen 10 ft. 10 in. visible from the extreme end of the hall. The results, while leaving much to the imagination, showed at any rate that a distinct image could be attained on the screen.

Southend Electrical Exhibition

An electrical exhibition organised by the Corporation Electricity Department with the assistance of the British Electrical Development Association, was opened on Monday by the Mayor. Among those present at the opening ceremony was Sir John Brooke, deputy chairman of the Electricity Commission, who is seen in our illustration inspecting one of the stands accompanied by Mr. J. Le Masurier, chairman of the Electric Lighting Committee, and Mr. A. C. Johnson, the borough electrical engineer. A most extensive display of domestic apparatus is on view, and the Corporation's stand depicts a suite of rooms consisting of a kitchen, bathroom and lounge electrically equipped. Cinematograph films and lectures are being given by the E.D.A., and cooking demonstrations by the General Electric Co., Ltd., Credenda Conduits Co., Ltd., and Messrs. Belling & Co., while music is provided by Messrs. E. K. Cole, Ltd. The Electric Lamp Manufacturers' Association stand consists of a demonstration shop window. Another exhibit showing a comprehensive collection

Mr. J. Le Masurier, Sir John Brooke, and Mr. A. C. Johnson at the Southend Exhibition

of lighting fittings, medical and domestic apparatus, has been arranged by a group of fourteen electrical contractors, and a model shop window has been erected to demonstrate good and bad lighting effects. The window is being dressed daily with the co-operation of local firms. The exhibition closes to-morrow (Saturday).

In connection with the exhibition, the Electricity Department has decided to install a hundred electric water heaters free of charge on consumers' premises for a period of three months, at the end of which the consumers will be given the option of purchasing the water heaters on hire-purchase terms. Electricity for water heating is supplied at ½d. per kWh.

Recent Contracts

The Hart Accumulator Co., Ltd., is supplying two 50-V storage batteries, having a capacity of 150 Ah, for operating the private telephone exchange at Unilever House, Blackfriars, E.C.4, the headquarters of Messrs. Lever Bros.

The Pulsometer Engineering Co., Ltd., has received a contract from the Erith Urban District Council for equipping three automatically controlled sewage stations. The plant will consist of four vertical spindle type "Stereophagus" pumps, two to be capable of delivering 1,200 g.p.m. each against a head of 60/66 ft. and absorbing 50 b.h.p. at 1,440 r.p.m. and two to deliver 850 g.p.m. each against 69/79 ft. head, absorbing 40 b.h.p. at 960 r.p.m. Two horizontal type "Stereophagus" pumps for dealing with 275 g.p.m. each against 23 ft. head, absorbing 7½ b.h.p. at 725 r.p.m. complete the order. The Cape Town Corporation has ordered a further two of these pumps, while other orders for pumps recently received are from Ilkeston Borough Council and Newquay Waterworks.

Messrs. C. A. Parsons & Co., Ltd., have received an order for a 20,000-kW turbo-alternator, generating at a pressure of 33,000 V. The machine is destined for the Salt River power station of the Electricity Commissioners of South Africa, the consulting engineers being Messrs. Merz and McLellan. This will be the third e.h.p. alternator of this type to be constructed by Messrs. Parsons, the first having been in successful operation at Brimsdown for over three years.

The Metropolitan-Vickers Electrical Co., Ltd., has received a contract from the Belfast City Tramways for twelve months' supply of "Cosmos" lamps for standard lighting and traction lamps.

A "Mazda" Display

The "Mazda" lamp display shown in the accompanying illustration has attracted large numbers of people to the Crown House windows in Aldwych. The background is in three planes, separately illuminated. Overhead cables, on towers,

PEARL
MAZDA
LAMPS
The quality and high efficiency of Pearl MAZDA Lamps encourage the wider use of electricity thereby improving the living and working conditions of the Nation

A display at Crown House, Aldwych

are lighted from behind to indicate the flow of current from the power station on the left, to the isolated electric house on the right. The model railway in the foreground is electrically operated and on it runs a goods train laden with miniature "Mazda" boxes.

Correction

The Electric Lamp Service Co., Ltd., ask us to state that their advertisement in our last issue was not intended to imply that they were jobbing off *British* lamps, but that having adopted British lamps as a regular line, they are disposing of their old stocks of foreign lamps.

Social Events

The second annual staff dinner of the Northern District of the Post Office Engineering Department was held at the County Hotel, Newcastle-on-Tyne, recently. A company of 150 sat down to dinner under the presidency of Mr. F. G. C. Baldwin, superintending engineer. The toast of "The Post Office Engineering Department" was proposed by Mr. C. H. Smith, of London, general secretary of the Post Office Engineering Union, who referred to the history and achievements of the Department. Lt.-Col. A. G. Lee responded. Mr. J. T. Bramwell, assistant superintending engineer, Northern District, proposed the toast of "The Visitors," and Capt. R. D. S. Norman replied.

On March 8th, at the Stretford Town Hall, the Metropolitan-Vickers Male Voice Choir held the second of its open invitation musical evenings. A varied programme was well received by a large audience.

Science Students Visit "Megger" Works

A party of 25 science students from Isleworth Training College visited the Acton works of Messrs. Evershed and Vignoles, Ltd., last Tuesday.

For Sale

Plymouth Corporation Stores Committee has surplus electrical plant for disposal.

Electrical goods will be sold by auction on March 22nd by Messrs. Knight, Frank & Rutley.

West Hampshire Electricity Co., Ltd., invites offers for d.c. meters and motors.

(See our advertisement pages to-day.)

A Factory Lighting Installation

We illustrate a section of the Sperry Gyroscope Company's works showing part of the new lighting installation. The

Efficient lighting at the Sperry Gyroscope Co.'s works

equipment consists of Ediswan "Mazdalux" reflectors in the main factory and stores, and Ediswan "Hermetica" lanterns in the paint spraying shops.

Manchester Tramwaymen's Wages

A meeting of Manchester tramwaymen held on March 13th decided not to accept the national agreement for a reduction in the wages of tramway workers. According to the *Manchester Guardian* a resolution was passed at the meeting demanding the appointment of a deputation to interview the general manager or the Transport Committee, and to ask that the Manchester men shall retain their present rates of pay.

New French Companies

Among the new concerns recently formed in France are the Société l'Omnium Téléphonique, Paris (19, Rue Lafayette), to manufacture telephonic and telegraphic apparatus; La Société Industrielle de Radiophonie, La Chaux-de Fonds (40, Rue du Progres), to manufacture telephonic, television, and radio apparatus; La Société Nouvelle des Equipements Electriques Contin Neuilly-sur-Seine (19, Rue de Lesseps); La Société de Transport d'Energie de l'Ile de France, Paris (16, Rue Chauveau-Lagarde) La Société d'Applications Téléphoniques, Paris (304, Rue de Vaugirard); La Société de Construction et d'Entretien de Reseaux Force et Lumière, Bourg-la-Reine, Seine (5, Grand Rue); and La Société des Forces Motrices de l'Arn, Paris (14, Rue Roquepine).

Young Accumulators

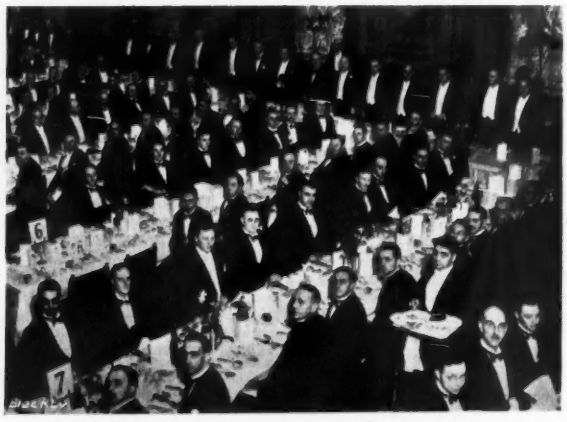
In the " City Notes " section of our last issue we published an official announcement that the name of the Young Accumulator Co., Ltd., was to be struck off the Register. We wish to make it clear that this announcement related to the old company and not to the present company, the Young Accumulator Co. (1929), Ltd.

Trade with Siam

A memorandum on the methods adopted by Government Departments in Siam in obtaining tenders for supplies has been prepared by H.M. Vice-Consul at Bangkok. United Kingdom firms wishing to obtain copies should communicate with the Department of Overseas Trade, 35, Old Queen Street, S.W.1, quoting reference number C.X.3837.

The Birmingham Electric Club

The annual dinner of the Birmingham Electric Club took place on March 11th at the Grand Hotel, with Mr. J. Entwistle (president) in the chair. Mr. Frank Hodges (Central Electricity Board) proposed the toast " The Birmingham Electric Club," which was responded to by the president. Mr. Hodges said we used to be afraid of the progress that other countries were making, and to fear that we would not catch up with the rest of the world. To-day the facts indicated that the contrary was the case. Great Britain's increase in electricity generation and consumption during the last five years was 34.9 per cent. In the United States it was 16.3 per cent., in Germany 14.6



The Birmingham Electric Club dinner

per cent., in Canada 12.6 per cent., and in Italy 21 per cent. Despite the industrial depression we could claim, relatively and absolutely, to have gone ahead of the whole world. The Central Board had practically completed the contract side of its work, and by the spring of 1933 it would have erected practically every tower and line from the North of Scotland to the West of Cornwall. The last tower in the 430 miles of high-voltage transmission lines, and the last tower in the low-voltage system, had been erected, and the 18 sub-stations had been completed.

The Board had constructed throughout England and Scotland 2,677 miles of high-voltage transmission lines, in addition to which it had erected 779 miles of low-voltage transmission lines, and it had spent £8,000,000 on the standardisation of frequency. Contracts had been placed for work on the high-voltage system, to the value of £21,000,000, and not a penny of that sum had been spent in any other country.

The civic toast was proposed by Mr. Alexander Ramsay, M.P. (chairman of the Engineering and Allied Employers' Association) and Alderman W. W. Saunders (Deputy Mayor) responded. The health of " the Guests " was proposed by Mr. J. M. Dunkley (vice-president of the Club), and replied to by Sir Felix J. C. Pole (chairman, Associated Electrical Industries, Ltd.).

The General Accessories Co., Ltd.

With reference to the notice relating to the General Accessories Co., Ltd., which appeared in our last issue, p. 393, we have received a letter from Mr. E. A. Chatfield, the secretary of the company, in which he states that a resolution was carried giving effect to the continuance of the business with the support of the whole of their suppliers, who were satisfied by independent investigation that the temporary embarrassment was solely attributable to an occurrence for which the management of the last eighteen months was in no way responsible, but which, however, resulted in a loss of over £20,000. Mr. Chatfield says that up to that time the company had for over twenty years carried on an entirely successful business, and suppliers expressed their confidence in the future of the business by their decision that it should be continued. The writer adds that the petition for the winding-up was purely for protective purposes, and was adjourned on March 14th pending the sanction of the Court to the scheme for the re-constitution of the company.

Trade Announcements

The Coventry Chain Co., Ltd., and Hans Renold, Ltd., have been taken over by the Renold & Coventry Chain Co., Ltd. Brompton Brothers, Ltd., which was a direct subsidiary of the first mentioned company, will, under the new arrangement, become a direct subsidiary of the Renold & Coventry Chain Co., Ltd., which company will act as sole selling agents for its products.

The Forward Electric Co., Ltd., has entered into arrangements with the Vorax Company of Rheydt, Germany, whereby it has acquired the sole British Empire manufacturing rights under the latter's patents. The " Electro-Broom " vacuum cleaner, previously marketed by the company, will no longer be supplied, and all its features are incorporated in the new " Bustler " cleaner.

Mr. F. W. Straw, of St. John's Street, Colchester, has opened a new department for electric wiring.

Mr. C. S. Lawson, radio and electrical engineer, Bury St. Edmunds, is shortly removing his business from 67, St. John's Street to premises on Cornhill.

Messrs. A. J. Coleman & Co., electrical and radio factors, 37-39, The Arcade, Northampton, have appointed Mr. G. Harris as their representative for Northampton and district.

The Gorleston Radio Stores, 2, Lowestoft Road, Great Yarmouth, have added a department for electrical work, including wiring.

Messrs. Buchan, Cartwright & Co., 2, Bridge Road, Harlesden, N.W.10, inform us that they are now manufacturing the " Utility " fixed-charge collector described in our issue of November 15th, 1929 (p. 874). They state that a number of improvements have been made in its design and construction.

" Becantee " Illuminations, Ltd., have appointed Astor Electric Lamps, Ltd., 4, West Street, Leeds (telephone : Leeds 21440), as their northern distributors. The district covered includes Leeds, Bradford, Halifax, Huddersfield, Dewsbury, Wakefield, Harrogate, York and Scarborough.

Engineer Sent to Prison

The Times reports that Henry Hallifield Oxley (48), an engineer, was convicted at Middlesex Sessions on March 7th of obtaining money without disclosing that he was an undischarged bankrupt and converting a sum of money to his own use. He asked that a further charge of fraudulently converting £1,000 belonging to Canon Lockett should be taken into consideration. The Chairman (Sir Montagu Sharp, K.C.) sent Oxley to penal servitude for three years.

New Catalogues and Lists

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Publication No. 7,053/0-2, dealing with a new air-break automatic switch.

Korting & Mathiesen Electrical, Ltd., 711 and 715, Fulham Road, S.W.6.—A card relating to " Kandem " universal reflector fittings for local illumination.

Midland Electric Manufacturing Co., Ltd., Birmingham.—List 193, giving particulars of the " Mendix " 10-amp. double-pole combined switch and fuses.

Elliott Brothers (London), Ltd., Century Works, Lewisham, S.E.13.—A number of catalogue sheets referring to switchboard, testing and recording instruments.

Frys (London), Ltd., 24-25, King Street, Minories, E.1.—A leaflet on " Enox " hacksaws.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—An announcement regarding the introduction of an increased range of " Full-o'-Power " batteries.

Wild-Barfield Electric Furnaces, Ltd., Elecfurn Works, North Road, Holloway, N.7.—A leaflet describing a new self-contained electric furnace for general purposes. Also particulars of " Kleenard " open hearth compound.

Forward Electric Co., Ltd., Perry Barr, Birmingham.—An illustrated leaflet on " Bustler " vacuum cleaners.

Westinghouse Brake & Saxby Signal Co., Ltd., 82, York Road, King's Cross, N.1.—A descriptive pamphlet (No. 11b) of metal rectifiers for measuring instruments.

T.B.T. Electric Co., Ltd., 171, Queen Victoria Street, E.C.4.—Illustrated lists relating to a.c. motors (No. 46), " Minor " electric pulley blocks (No. 51) and small rotary convertors for neon work, &c. (No. 60).

Robert Hornby & Co., Ltd., 7, Carlisle Street, Dean Street, W.1.—A folder illustrating the method of manufacture, testing, &c., of the company's meters.

Heyes & Co., Ltd., Water-Hayes, Electrical Works, Wigan.—The March number of the "Wigan Review," containing particulars of "Wigan" explosion proof fittings.

British Electric Domestic Appliances, Ltd., 3, Hanover Court, Moor Lane, E.C.2.—Leaflets and show-card illustrating and describing the "Mary Ann" vacuum cleaner.

British Electric Transformer Co., Ltd., Wellington House, Strand, W.C.2.—Leaflets dealing with the new "Tricity" wash boiler No. 794 and the latest type of combination cooker (No. 800) in de luxe finish.

Bankruptcy Proceedings

Moses Haar (known as Maurice Haar, lately trading as "Fleet Electric Service"), electrical engineer, 26, Ivy Lane, Newgate Street, E.C.—The public examination was held on March 10th before Mr. Registrar Warmington at the London Bankruptcy Court, the accounts showing liabilities of £434 and no assets. The debtor stated that he was born in Galicia, came to this country in 1905, and was naturalised in 1925. He began business in 1926 and in June, 1928, he was joined by a partner, who paid £200 for a half-share of the business, but as the trading was not successful, retired without payment nine months afterwards. In January, 1931, his stock and effects were seized and sold under an execution and the business was closed. The debtor attributed his insolvency to bad trade and to the gross profits having been insufficient to cover overhead expenses and drawings. The examination was concluded.

A. H. Crump (Selwyn Electrical Engineering Co.), electrical engineer, 202, Walworth Road, S.E.—Discharge suspended for two months until April 10th.

C. Bassham (Ashton & Holt), electrical engineer, 16, Cross Street, Ryde, I. of W.—Receiving order made March 9th, on debtor's own petition.

P. R. Andrews, electrical engineer, Middleton Street, Wymondham.—Receiving order made March 8th on debtor's own petition.

W. F. O. Sewell (Commercial Electrical Co.), electrical engineer, 24, James Street, Bradford.—Last day for receiving proofs for dividend, March 26th. Trustee, Mr. J. O. Morris, 71, Manningham Lane, Bradford, Official Receiver.

Company Liquidations

North Staffordshire Tramways Co., Ltd.—Winding up voluntarily. Liquidators: Messrs. R. P. Beddow and H. W. Davis, 88, Kingsway, W.C.

City Electric Wiring Co., Ltd.—Winding up voluntarily. Liquidator: Mr. T. A. Perry, 45, The Ridgeway, Erdington, Birmingham.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

	Price Mar. 16th.	Fortnight's Inc. or Dec.
CHEMICALS, Etc.		
a Acid, Oxalic	per lb. 5½d.	—
a Ammoniac, Sal	per ton £60	—
a Ammonia, Muriate (large crystal)	" £52	—
a Borax	" £17	—
a Copper Sulphate	" £25 10s.	—
a Potash, Chlorate	per lb. 3d. to 4d.	—
a " Perchlorate	" 5½d.	—
a Shellac T.N.	per cwt. £3 15s.	—
a Sulphur Commercial	" £11	—
a " Roll	" £11	—
a Soda, Chlorate	per lb. 3d.	—
a " Crystals	per ton £5 to £5 5s.	—
a Sodium Bichromate, casks	per lb. 4d.	—
METALS, Etc.		
b Aluminium, Ingots	per ton £95 to £100	—
b " Wire	per lb. 1/1 to 1/9	—
b " Sheet and Foil	" 1/1½ to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I	per ton net £123	£8 dec.
Grade II	" £89	£5 dec.
Grade III	" £53	£1 dec.
Brass (rolled metal 2" to 12" basis)	per lb. 7½d.	—
c " Tubes (solid drawn)	" 9½d. to 9½d.	½d. dec.
c " Wire, basis	" 7½d.	—
c Copper Tubes (solid drawn)	" 10d.	½d. dec.
c " Bars (best selected)	per ton £66	£2 dec.
g " Sheet	" £66	
g " Rod	" £66	
g " (Electrolytic) Bars	" £38	—
d " " Sheets	" £68	—
d " " Wire Rods	" £42	—
d " " H.C. Wire	per lb. 6½d.	½d. dec.
d Ebonite Rod	" 1/3 to 1/6	—
n " Sheet	" 1/3 to 1/6	—
h German Silver Wire	" 2/2	—
h Gutta-percha, fine	" nom.	—
h India-rubber, Para fine	" 3½d.	½d. dec.
i Iron, Pig (Cleveland No. 3)	per ton 58/6	—
i " Wire, galve. No. 1, P.O. qual.	" £20	—
g Lead, English pig	" £14 5s.	—
g Mercury	per bot. £19 to £19 5s.	—
e Mica (in original cases) small	per lb. 6d. to 3/6	—
e " " medium	" 4/- to 8/-	—
e " " large	" 8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings	" 1/1½d.	—
p " " drawn bars & rods	" 11d.	½d. dec.
p " " rolled strip & sheet	" 11d.	½d. dec.
p " " wire	" 1/0½d.	½d. dec.
o Platinum	per oz. £10 13s.	8s. dec.
d Silicium Bronze Wire	per lb. 7½d.	—
r Steel, magnet, in bars	" 7½d.	—
g Tin, Block (English)	per ton £129 5s. to £131 5s.	£10 dec.
n " Wire, Nos. 1 to 16	per lb. 3/1	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Boiling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Aldershot.—ASSISTED WIRING.—The Electricity Committee recommends that a scheme of assisted wiring should be arranged for 25 houses being erected by the Corporation at the Park site.

Australia.—ADELAIDE.—The accounts of the Electricity Department for the twelve months ended March 31st last show a total revenue of £747,826, as compared with £834,022 in 1930. The working expenses amounted to £299,015, those for the previous year being £389,809. The capital expenditure amounted to £121,431. The number of consumers decreased by 475 to 83,843, but the total load rose from 158,550 kW to 162,506 kW; electrical energy sold fell from 60,978,785 to 52,351,416 kWh. In spite of the depression a considerable increase in the domestic and power load was recorded.

Barrow-in-Furness.—REVISED CHARGES.—The following alterations in the electricity tariff are to be introduced in Barrow:—Lighting flat rate: First 200 kWh per quarter, 6d. per kWh; over 200 kWh, 5d. "Size of house" tariff for private houses: Fixed charge of 36s. per annum for an area not exceeding 800 sq. ft., 40s. for area of between 801 and 1,000 sq. ft., and 5s. for each additional 200 sq. ft., plus a "unit" charge of ¾d. for first 240 kWh per quarter and ½d. beyond. Domestic and industrial heating, cooking and water heating: First 240 kWh per quarter, ¾d. per kWh; over 200 kWh, ½d. Consumers paying ½d. per kWh in excess of the above charges are supplied with a cooker free subject to their guaranteeing to use 1,000 kWh per annum. The corresponding

The dam at Imatra Falls, Finland

alterations with regard to the Dalton and rural district are as follows:—Lighting flat rate: 7½d. and 6½d. "Size of house" tariff: "Unit" charges, 1d. and ¾d. Domestic heating, cooking and water heating: 1d. and ¾d. Industrial heating, cooking and water heating: 5 per cent. above the Barrow charges.

Beccles.—STREET LIGHTING.—The Town Council has accepted the tender of the East Anglian Electric Supply Co., Ltd., for lighting the streets of the town.

Bradford.—POWER FOR CHEMICAL WORKS.—The Electricity Committee is to install electric power at the works of the Bierley Chemical Co., Ltd., at an estimated cost of £842.

Brandon (Durham).—ELECTRICITY SCHEME.—The Urban District Council has under consideration a scheme for the supply of electrical energy to the East Ward of Brandon.

Broxburn.—NEW CABLE.—It was reported at a recent meeting of Broxburn District Council that it is proposed to lay a new cable from Linlithgow to Winchburgh at a cost of £5,000.

Buckie.—SUPPLY FOR PORTESSIE DISTRICT.—The Town Council has decided to extend the electricity supply by underground mains to the Portessie district of the town.

Canterbury.—ELECTRICITY FOR NACKINGTON.—The City Council has offered to lay an underground l.p. cable to supply Nackington at an estimated cost of £1,296, subject to prospective consumers guaranteeing an annual revenue equal to 10 per cent. of the estimated cost for ten years. The Council had been asked to provide a supply by an overhead line, but could not agree to this proposal.

REVISION OF CHARGES.—The following amended electricity tariff has been adopted:—Lighting: First 4,000 kWh per quarter, 4½d. per kWh; beyond, 4d. (There was previously a sliding scale ranging from 5d. for 100 kWh per quarter to 4d. beyond 15,000 kWh.) Power: First 250 kWh per quarter, 1½d. per kWh; over 250 kWh, 1¾d.; over 500 kWh, 1¼d.; over 2,000 kWh, 1d.; over 5,000 kWh, ¾d. Heating: 1d. per kWh. Maximum demand: Demand indicated, 8d.; all excess energy, 1½d. per kWh. Prepayment meters: 5½d. per kWh.

Cardiff.—MAINS EXTENSIONS.—The Electricity Committee is to extend feeder mains at a cost of £3,620.

Cheltenham.—PUBLIC LIGHTING IMPROVEMENTS.—The Town Council has decided to spend £500 per annum for a certain number of years on improving the public lighting.

Clay Cross.—SPECIAL ORDER.—The Clay Cross & District Electric Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the urban district of Clay Cross and the parishes of Ashover, Brackenfield, Morton, Shirland and Higham, Stretton, Tupton, Wessington, Wingerworth and Woodthorpe in the Chesterfield rural district.

Continental.—FINLAND.—Suomi, or the "Land of a Thousand Lakes," is peculiarly favoured by nature in the matter of her many streams potentially productive of power. South-east Finland is drained by a great system of lakes known as "Saima," which discharges through the short river Vivoski, into Lake Ladoga, passing some five miles after leaving Lake Saima, through the Rapids of Imatra. Our illustration on page 429 shows the large dam at the Imatra Falls, where 141,312 h.p. is generated.

The largest rapids in Finland, however, are those of Pyhakoski, on the Ule River, with a normal capacity of 197,317 h.p. There are in Finland, altogether, 1,442 rapids, with a minimum fall of half a metre, and a minimum force, at normal height, of 50 h.p., the total being calculated at over two and a half million h.p.

Dorchester.—PROPOSED HOSPITAL INSTALLATION.—The Corporation is considering the installation of electric lighting at the isolation hospital.

Duffield.—PUBLIC LIGHTING.—The Parish Council has accepted the proposal of the Derby Corporation Electricity Department to light and maintain the existing public electric lamps and to convert the remaining gas lamps to electricity.

Dundee.—INSTALLATION SCHEME.—A proposal to install electric lighting in East House, at a cost of £492 is being considered by the Public Assistance Committee.

Ealing.—LOANS.—The Electricity Committee is to apply for sanction to loans of £20,000 for mains for a supply to new estates and £30,000 for the completion of the second stage of the 33,000-V three-phase scheme.

Eastbourne.—EXTENSIONS.—The Electricity Committee is to extend mains at Hailsham at a cost of £490. Sanction to a loan of £25,000 for extensions is to be applied for.

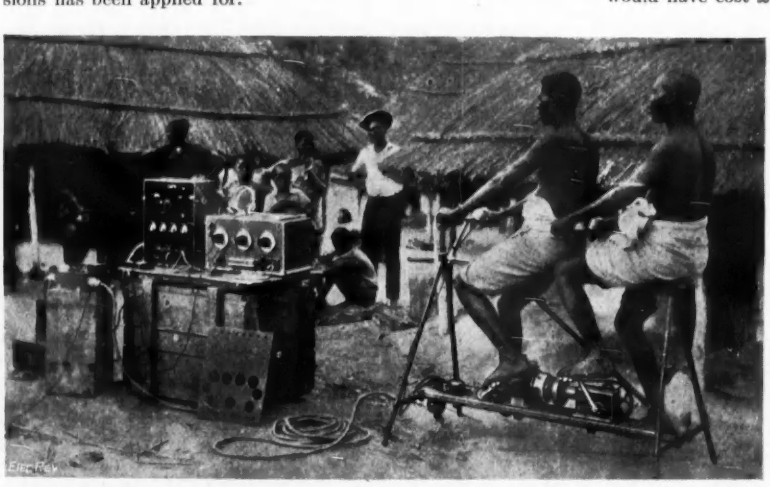
Elgin.—CHEAPER ELECTRICITY.—The Elgin Electric Supply Co., Ltd., has decided to reduce its charge for electricity for lighting from 8d. to 7d. per kWh, and that for power and heating from 3d. to 2d. per kWh.

Galloway.—EXTENSION SCHEME.—There is a prospect in the near future of a further development of the Central Electricity Board's powers throughout South-West Scotland by the extension of the scheme from Tongland, in Kirkcudbright, to Glenluce, in Wigtonshire. Wigtonshire Electricity Co., under its Special Order of 1931, has the necessary powers for the distribution of electricity throughout the country, and it is understood that the survey of the area from Glenluce, where the transformer station will be erected at Newton-Stewart, at the eastern side of the county, is now being undertaken to ascertain the probable cost of the extension.

Gravesend.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £500 to supply houses in Ascot Road and Gatwick Road.

Great Yarmouth.—SUPPLY TO ACLE.—The Town Council has agreed to the cancellation of an agreement with the Norwich City Council for the supply of electricity in bulk at Acle subject to the payment of compensation.

EXTENSIONS.—Sanction to a loan of £8,873 for feeder extensions has been applied for.



A two-man-power radio station: a novel type of apparatus constructed by the Marconi Company for use in Northern Rhodesia

Hastings.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to provide electricity for power purposes to the Lunsford Brick Co. at Northiam.

Isle of Thanet.—SUPPLY TO MINSTER DISTRICT.—The Rural District Council has been informed that the Electricity Commissioners have granted the application of the South-Eastern Electric Power Co. for authority to supply electricity to Minster and district, and have refused the application of the Isle of Thanet Electric Supply Co., Ltd., for similar powers.

Kirbymoorside.—INAUGURATION OF SUPPLY.—Kirbymoorside was supplied with electricity for the first time on March 15th.

Newport (Mon.).—SPEEDING UP OF ELECTRICITY SCHEME.—At a recent meeting of the Electricity Committee, the borough electrical engineer reported with regard to the grid sub-station at Newport and the extensions and alterations at the East Power Station and said that the Central Electricity Board appeared to consider it necessary that the Newport scheme should be speeded up. He anticipated that he would shortly be in a position to submit the scheme with estimates, &c., so that the Board's proposals could be carried out in the main before next winter. The Committee instructed him to invite tenders in connection with the scheme.

New Zealand.—WELLINGTON.—For the twelve months ended March 31st, 1931, the revenue from the electricity supply undertaking was £357,287 (£1,638 less than in the previous year). The capital expenditure amounted to £65,094. Electricity sold amounted to 47,761,586 kWh, as compared with 41,329,434 kWh in the previous year, and the maximum load rose from 15,424 to 18,528 kW. The average revenue per kWh fell from 2.06d. to 1.63d., while the total number of consumers increased from 26,700 to 28,700.

AUCKLAND.—The accounts of the Auckland Electric Power Board (general manager: Mr. R. H. Bartley) for the year ended March 31st, 1931, showed a total revenue of £656,660, as compared with £645,062 in 1929-30, while the working expenses amounted to £361,278 (£291,346), leaving a surplus of £8,986 (£76,641). Sales of electricity amounted to 114,506,620 kWh (103,719,531 kWh), the revenue per kWh sold being 1.393d. (1.488d.). The maximum load rose from 28,600 to 29,696 kW.

Northern Ireland.—OMAGH.—The Urban District Council is to apply for sanction to a loan of £3,000 for the extension of the local electricity scheme.

Oxford.—CHANGE-OVER.—At a meeting of the Electricity Committee held recently, the proposed scheme for the change-over of the supply system was received from the chief electrical engineer. It is anticipated that the work will take about a year and a half to complete and will cost about £150,000. The Committee recommends putting the work in hand at once, and has authorised the electrical engineer to purchase all the necessary motors and small apparatus that may be required for installation at consumers' premises in connection with the change-over, pending the acceptance of a tender for the bulk supply of apparatus.

Portsmouth.—EXTENSIONS.—The Electricity Committee is to lay a cable from Sarisbury to Warsash, at a cost of £5,510, and also erect a sub-station at Warsash.

Scarborough.—LIGHTING OF PLEASURE GARDENS.—The Town Council has agreed to spend £3,608 in connection with the electric lighting of the North Bay Pleasure Gardens.

South Africa.—BRAKPAN.—Extensions and alterations of the town's electrical installation are to be carried out at a cost of £26,000.

JOHANNESBURG.—The Tramways and Lighting Committee has adopted a report by Mr. A. T. Rodwell, general manager of the Municipal Electricity Department, which involves the expenditure of £333,000 on extensions at Jeppe Street power station. This is a modification of the previous scheme, which would have cost £500,000.

Spalding. — LOAN SANCTIONED. — The Urban District Council has received sanction to a loan of £614 for sub-station equipment, &c.

Stourbridge.—APPROVAL OF SPECIAL ORDER.—The Town Council has approved a draft Special Order submitted by the Midland Electric Corporation for Power Distribution, Ltd., extending the company's period of tenure.

Wakefield. — REWIRING OF COUNTY BUILDINGS.—The West Riding County Council has prepared a revised scheme for rewiring the County Hall and offices at Wakefield at a cost of £1,350.

Walton - on - Thames. — REDUCED CHARGES.—The Urban District Council has reduced the charges for electricity as follows: Lighting: From 6d. to 5½d. per kWh. "Unit" charge for domestic tariffs: From 1½d. to 1d. on tariff "A," and from 1d. to ½d. on tariff "B."

Westhaven. — ELECTRICITY SOON. — An agreement has been reached whereby the town will shortly be supplied with electricity by the Grampian E.S. Co.

Traction

Bradford.—TRAFFIC CONTROL.—The Watch Committee is considering the installation of automatic traffic signals costing £2,500.

Continental.—FRANCE.—Following on the success which has been obtained with electric traction on the line from Paris to Vierzon (128 miles) and the branch line from Bretigny to Dourdon (15 miles), the Paris-Orleans Railway has decided shortly to extend its electrification scheme to the Orleans-Tours (73 miles) and Vierzon-Brive (187 miles) lines. For the extension, 25 express locomotives have been ordered from the Compagnie Electro-Mécanique (licensees of the Brown, Boveri Co.), and will be made in France in collaboration with the Compagnie Fives-Lille. The locomotives will be built for a loading of 20 tons per driving axle and for a maximum speed of 81 m.p.h. The total weight will be about 135 tons, and the equipment will consist of four driving motors having a total output of about 4,000 h.p., hourly rating at the shafts, at a speed of 490 r.p.m.

Gloucester.—SUSPENSION OF TRAM SERVICE.—The Corporation is to suspend the running of trams on the Hucclecote route at the end of this summer.

London.—NEW TUBE STATION.—Chancery Lane Underground station is to be moved to the junction of Gray's Inn Road and Holborn, where four new entrances are to be made. Five escalators will be installed, and it is expected that the new station will be completed by the end of 1933. The cost is estimated at £230,000.

NEW TRAFFIC SIGNALS INAUGURATED.—On Monday, Sir Maurice Jenks, the Lord Mayor, set into operation at the junction of Gracechurch Street and Leadenhall Street a new system of automatic traffic signals stated to be the first of its kind in Europe. The signals, which were constructed by the Automatic Telephone Manufacturing Co., Ltd., are operated automatically by the weight of the traffic passing over strips let into the roadway. A picture of the ceremony appears on this page.

Manchester.—TRAFFIC SIGNALS.—The Paving Committee is to install automatic traffic signals at Withington.

Newcastle-upon-Tyne.—AUTOMATIC TRAFFIC CONTROL.—The City Council is to erect a traffic signal at the junction of Market and Pilgrim Streets.

"LUXURY" TRAMCARS.—Six "luxury" tramcars have been put into service on the Fenham route.

New Zealand.—WELLINGTON.—For the year ended March 31st, 1931, the revenue of the city tramways decreased from £478,547 to £453,676, and working expenses fell from £377,348 to £355,360, capital charges increasing by £2,298 to £98,066. The net result was a deficit of £3,488 against a profit of £1,041 for the previous year. Car mileage rose from 4,308,624 to 4,395,335, but receipts per car mile declined from 25.53d. to 23.87d.

CHRISTCHURCH.—The report on the operation of the Christchurch tramways during the year ended March 31st, 1931, shows that, compared with the previous year, the car mileage fell from 2,603,547 to 2,504,101, while the tram passengers also decreased from 23,891,144 to 22,253,096. The gross revenue was £263,658, as compared with £264,249, but the working expenses decreased from £189,812 to £183,952. There was a surplus of £4,388, as compared with a deficit of £6 in 1929-30.

Stratford-on-Avon.—TRAFFIC SIGNALS.—The Warwickshire County Council is to provide traffic signals at Stratford-on-Avon.

Communications

Australia.—BROADCASTING CONTROL.—In moving the second reading of the Australian Broadcasting Bill on March 9th, Mr. Fenton, the Commonwealth Postmaster-General, declared that he proposed, where practicable, to adopt the B.B.C. system of control. He believed that there was a great future for Emipre broadcasting and transmissions from Great Britain would be broadcast throughout Australia.—*Reuter* (Canberra).

Bulgaria.—TELEPHONY.—A telephone service between all parts of Great Britain and Northern Ireland and Bulgaria (limited initially to Sofia) became available for public use on March 14th.

Canada.—RADIO LICENCES.—By the issue of an Order-in-Council the cost of broadcast radio receiving licences has been doubled to two dollars per annum. Over 300,000 registered sets are affected.—*Reuter's Trade Service* (Ottawa).

Colombia.—RADIO-TELEPHONY.—It is reported that plans are in hand for the establishment of a wireless telephone service between Bogota, the Atlantic coast cities, and foreign countries

Egypt.—BROADCASTING PROPOSAL.—Our correspondent in Cairo reports that Marconi's Wireless Telegraph Co., Ltd., has submitted to the Egyptian Government a scheme for the construction of a broadcasting station in Cairo, which is now under consideration by the Ministry of Communication. The scheme involves the formation of an Anglo-Egyptian Company, 55 per cent. of the shareholders being of Egyptian nationality, to construct a station in Cairo for both relaying foreign and also broadcasting Egyptian programmes. The Government would in return have the right to use the station at any time. The company would impose dues on every set in Egypt amounting to about 16s. per annum, of which 33⅓ per cent. would be taken by the Government. In Cairo there are about 16,000 radio sets.

Great Britain.—RADIO EXCHANGES.—The Lord Mayor of York recently inaugurated the central broadcast relay station at Yearsley Bridge, which has been established by York Relay Services, Ltd. Two "sub-stations" are in operation and others will be provided where and when required.

Local wireless retailers have protested to the Bromley Town Council against the proposed establishment of a radio relay service.

The Cheltenham Highways Committee has refused to grant permission for Mr. G. B. Clark, of Ipswich, and Mr. W. S. Cooper, of Gloucester, to establish a wireless relay system in the town.

India.—STATE BROADCASTING.—The Government of India has decided to retain the State broadcasting service. An announcement to this effect was made in the Assembly last week by Sir Joseph Bhore, Industries and Labour Member of the Executive Council, who stated that it was intended that the service should be on a self-paying basis. Sir Joseph introduced a Bill raising the import duty on wireless reception apparatus from 25 to 50 per cent. *ad valorem*, with a view to covering the cost of the service from the revenue derived from this legislation.—*Reuter* (New Delhi).

The Lord Mayor inaugurating the City's new traffic signals

CABLE AGREEMENT.—An agreement whereby the working of the cable services in India will be taken over by the Indian Radio-Telegraph Co. from Imperial and International Communications, Ltd., has been concluded in Bombay. The new working, which will be in force for 12½ years, comes into operation on July 1st and the new company will be known as the Indian Radio Cable Communications Co.—*Reuter* (Bombay).

Japan.—NEW TELEPHONES.—The installation of new telephones at the rate of 23,000 per year is being planned by the Japanese Ministry of Communications.

London.—TELEVISION.—The B.B.C. is equipping one of its studios at Broadcasting House, its new London headquarters, with apparatus hired from Baird Television, Ltd., in preparation for a series of transmissions on four nights weekly. Sound will be broadcast on the 399-metre, and vision on the 261-metre wavelengths from the Brookman's Park station. According to *The Times*, the B.B.C. has assured the Baird Co. that the arrangement will continue at least until March, 1934.

New Zealand.—RADIO AWARD.—The Radio Broadcasting Company has been awarded the sum of £58,646 by the Arbitration Court called in by the Government to adjudge the company's assets in the four broadcasting stations recently taken over by the Government. The company's licence expired in December, and has not been renewed. Broadcasting in New Zealand is now to be controlled by an independent board modelled on the B.B.C.—*Reuter* (Wellington).

Portugal.—NEW RADIO STATION.—The Cabinet is expected to approve a contract with a British firm for the erection at Lisbon of a national radio broadcasting station with a power of 20 kW. The wavelength to be used will be of the order of 400 metres.—*Reuter* (Lisbon).

Switzerland.—NEW RADIO STATION.—For the completion of the "regional" broadcasting scheme for Switzerland, the Swiss Administration of Telegraphs and Telephones has ordered a new Marconi transmitting station to be erected near Tessin, in Italian Switzerland. The regional transmitters for German Switzerland and French Switzerland are already in operation at Beromunster and Sottens, respectively. The new station, which is to be erected on Monte Ceneri, is expected to be in operation by the end of this year. It will have an energy of 15 kW unmodulated power in the aerial.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—LAUNCESTON (TAS.).—April 25th. City Council. Motor generator. (A.X. 11291.)*

Belgium.—BRUSSELS.—March 23rd. Régie des Télégraphes et des Téléphones, Salle de la Madeleine. Supply and laying of telephone cables in the Liège district.

Dundee.—April 7th. Electricity Department. Meters. (See this issue.)

Eccles.—March 21st. Electricity Committee. Twelve months' supply of cable joint boxes. Borough electrical engineer, Electricity Department, 1, King Street.

Egypt.—CAIRO.—March 28th. Ministry of the Interior. Electrically driven pumping set, switchboard instruments, etc., for Minia. (G.X. 11252.)*
March 31st. Meters for Sohag Municipality. (A.X. 11295.)*
April 23rd. Meters for Aswan, Dessouk, Guirgueh, Deirout and Akhmim. (A.X. 11297.)*
April 23rd. Ministry of Public Works. Pumping station plant. (G.X. 11276.)*

Exminster.—March 23rd. Devon Mental Hospital Committee. Six months' supply of electrical goods, etc. Mr. Cecil Masters, clerk.

Galloway.—April 8th. Galloway Water Power Co. 60-ton overhead electric travelling crane. (See this issue.)

Great Crosby (Liverpool).—March 29th. Urban District Council. Twelve months' supply of electric lamps. Mr. J. A. Wright, surveyor, Town Hall.

Great Western Railway.—May 2nd. Electric wires and cables, telegraph ironwork, and lamps. (March 11th.)

India.—NEW DELHI.—March 31st. India Store Department. Rubber-covered cables. (A.X. 11286).*
April 7th. Lead-covered cables. (A.X. 11285.)*

London.—BETHNAL GREEN.—March 21st. Borough Council. Electric lighting installation work at a block of tenement buildings. (March 4th.)
CENTRAL ELECTRICITY BOARD.—April 11th. 33-kV overhead transmission lines. (March 11th.)
April 18th. Metering equipment for South-West England and South Wales Scheme. (See this issue.)

Manchester.—March 19th. Electricity Committee. Voltage variation equipment. (March 4th.)
March 24th. Central Purchasing Committee. Twelve months' supply of incandescent lamps for Corporation Departments. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

Morley.—March 21st. West Riding Education Committee. Installation of electric lighting at the Grammar School (Textile Department). Education officer, County Hall, Wakefield.

New Zealand.—WELLINGTON.—June 2nd. Government Railways. Butt and arc welding sets. (A.X. 11279)* Electrically-operated 15-ton overhead travelling crane. (A.X. 11281.)*

Northern Ireland.—ELECTRICITY BOARD.—April 20th. L.p. distribution systems in a number of towns and villages. (See this issue.)

Rosslynlee.—March 26th. Midlothian and Peebles District Asylum. Supplies, including electrical fittings, for six months. Mr. C. L. Addison-Smith, clerk, 9, Heriot Row, Edinburgh.

South Africa.—DURBAN.—March 30th. Corporation. Cadmium copper conductor. (See this issue.)

Walthamstow.—March 23rd. Electricity Department. Cables. (March 4th.)

Warrington.—April 4th. Electricity Department. Transformers. (See this issue.)

Westhoughton (Lancs).—March 19th. Urban District Council. Twelve months' supply of metallic filament lamps. Mr. G. Hayes, U.D.C. surveyor, Town Hall.

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Acton.—Library Committee. Recommended. Re-wiring at library and fittings (£125).—R. A. Taylor.
Highways Committee. Accepted. Stand-by charging plant at depôt for electric vehicles (£453).—Twentyman & Willmott, Ltd.

Barrow-in-Furness.—Corporation. Accepted. Master frequency controller.—Synchronome, Ltd. Bare copper wire.—Thomas Bolton & Sons, Ltd. Portable power rammer.—C. H. Johnson & Sons, Ltd.

Bradford.—Electricity Committee. Recommended. Cable for 12 months.—Siemens Bros. & Co., Ltd.; Macintosh Cable Co., Ltd.

Cardiff.—Electricity Committee. Accepted. Illuminated advertising sign for power station (£226).—General Electric Co., Ltd. Two 1,000-kVA transformers (£388 each).—Fuller Electrical & Manufacturing Co., Ltd. Sub-station switchgear (£360).—New Switchgear Co. Water screening plant (£381).—Ledward & Beckett, Ltd.

Colchester.—City Council. Accepted. Automatic system of internal telephones at the new electricity offices (£120).—Trusloves, Ltd.

Dewsbury.—Housing Committee. Accepted. Wiring 20 houses at Field Lane Estate (£126).—W. Angus.

Dundee.—Works Committee. Accepted. Installation of three elevators in the new City Square buildings (£1,747).—Bennie, Ltd.

Hastings.—Electricity Committee. Recommended. Six switch and transformer kiosks and meters.—Metropolitan-Vickers Electrical Co., Ltd. Meter boards.—Messrs. Wootton & Co., Ltd. Service joint boxes and fittings and cut-outs.—W. Lucy & Co., Ltd. Straight-through boxes for 3,300-V, 500-V ironclad cut-outs and v.i.r. cables.—W. T. Henley's Telegraph Works Co., Ltd. Joint boxes, compound and paper-insulated cables.—W. T. Glover & Co., Ltd.

London.—LEWISHAM.—Town Hall Committee. Recommended. Electrical work in connection with stage equipment (£335).—Theatre Equipment Co., Ltd.

Lowestoft.—Electricity Committee. Accepted. Construction of overhead lines from Oulton to Gunton and from Pakefield to Carlton (£799).—Callender's Cable & Construction Co., Ltd.

Manchester.—Housing Committee. Accepted. Electrical installations in houses on Withington and Wythenshawe Estates.—R. H. Clampett & Co. Electrical installations in houses on Heaton Park and Victoria Avenue East Estates.—Hall and Stinson, Ltd.
Electricity Committee. Electric cookers for twelve months.—Revo Electric Co., Ltd.; Jackson Electric Stove Co., Ltd.; Credenda Conduits, Ltd. 6,600-V switchgear at Dickinson Street station and Stuart Street station, and supervisory control gear, Queen's Park sub-station.—Ferguson, Pailin, Ltd. Neutral earthing equipment, Queen's Park sub-station.—Erskine, Heap & Co., Ltd.
Education Committee. Accepted. Electrical installation in schools:—Birley Street.—A. E. Sudlow & Co. Southall Street and Central High School for Boys.—R. Seddon & Sons. City Road, Burgess Street, Wheler Street, and Cavendish School.—S. H. Heywood & Co., Ltd. Armitage Street.—R. H. Clampett & Co. Mansfield Street.—Collier & Co.

Portsmouth.—Electricity Committee. Recommended. Cable (£3,182) and construction of overhead lines (£1,251).—Johnson & Phillips, Ltd. Four 200-kVA transformers (£98 10s. each).—British Electric Transformer Co., Ltd. House service cut-outs.—General Electric Co., Ltd.

Wolverhampton.—Sewerage Committee. Accepted. Installation of electrically-driven centrifugal pump at sewage works (£370).—Rees Roturbo Manufacturing Co., Ltd.

Forthcoming Events

British Electrical Development Association.—Friday, March 18th. Savoy Hotel (Victoria Embankment entrance), W.C. 3 p.m. Annual general meeting. 7.30 p.m. City of London Electric Restaurant, E.C. Salesmanship conference. "The Heating of Buildings." Mr. R. Grierson.

Batti-Wallahs' Society.—Friday, March 18th. Hotel Metropole, W.C. Annual dinner and dance.

Birmingham Electric Club.—Friday, March 18th. Grand Hotel, Birmingham, 7 p.m. "Electric Traction." Mr. E. T. Hippisley.

London Society.—Friday, March 18th. Royal Society of Arts, W.C. 5 p.m. "Illuminating London." Mr. P. Good (associated with Mr. J. E. Ames).

Manchester Electro-Harmonic Society.—Friday, March 18th. Waldorf Hotel, Manchester. 7 p.m. Smoking concert.

Illuminating Engineering Society.—Friday, March 18th. Royal Society of Arts, W.C. 7.15 p.m. "The Application of Electric Light to Agriculture." Mr. F. E. Rowland.

Physical Society.—Friday, March 18th. Imperial College of Science, South Kensington, S.W. 5 p.m. Annual general meeting.

Royal Institution.—Saturday, March 19th. Institution, London. 3 p.m. "The Electron." Lord Rutherford.

Institution of Electrical Engineers.—Monday, March 21st. Institution, London. 7 p.m. Informal meeting. Discussion on "The Electrical Recording of Sound." Opened by Mr. G. H. Nash. (*Meter and Instrument Section*).—Friday, March 18th. Institution, London. 7 p.m. Informal discussion. (*North-Eastern Students' Section*).—Saturday, March 19th. 2.30 p.m. Visit to Dunston power station. (*Western Centre*).—Monday, March 21st. Swansea. Faraday lecture, "Everyday Uses of Electricity." Prof. J. K. Catterson-Smith. (*South Midland Centre*).—Monday, March 21st. The University, Birmingham. 7 p.m. "The Change-over of Low-Tension Distribution Systems from Direct Current to Alternating Current." Messrs. H. Blades and A. C. McQueen. (*North Midland Centre*).—Tuesday, March 22nd. Hotel Metropole, Leeds. 7 p.m. Informal discussion. "The Training of Electrical Engineers." Opened by Prof. E. L. E. Wheatcroft. (*North-Western Centre*).—Tuesday, March 22nd. Engineers' Club, Manchester. 7 p.m. "The Change-over of Low-Tension Distribution Systems from Direct Current to Alternating Current." Messrs. H. Blades and A. C. McQueen. (*Scottish Centre*).—Tuesday, March 22nd. North British Station Hotel, Edinburgh. 7 p.m. "Commercial Cooking by Electricity." Dr. T. Settle. (*London Students' Section*).—Tuesday, March 22nd. Institution, London. 6.15 p.m. President's annual address. "Starting-up." Capt. J. M. Donaldson. (*Wireless Section*).—Wednesday, March 23rd. Institution, London. 6 p.m. "Studies in Radio Transmission." Mr. T. L. Eckersley.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, March 22nd. Institution, Glasgow. "Diesel Electric Locomotives." Mr. R. Sulzer.

Edinburgh Electrical Society. Wednesday, March 23rd. Y.M.C.A., St. Andrew Street, Edinburgh. 8 p.m. Annual meeting.

Electrical Power Engineers' Association (*Manchester Technical Group*).—Wednesday, March 23rd. Geographical Hall, St. Mary's Parsonage, Deansgate, Manchester. 7.15 p.m. "Changing D.C. Consumers over to A.C." Mr. A. H. Fay.

Notes

The Revival of Industry

The annual dinner of the North Midland Centre of the I.E.E. took place on March 11th at the Hotel Metropole, Leeds. Mr. R. G. Ward (Sheffield), chairman, was prevented by indisposition from attending and Mr. R. M. Longman (vice-chairman) presided. The speeches to various toasts turned very largely on the subject of ways and means for reviving British industry and particularly was it stressed by several speakers that the country's renewed prosperity must depend very greatly on a revival in the heavy engineering industries, to which electric power offered a service of very real importance.

Capt. Donaldson, president, I.E.E., responding to the toast of "The Institution," referred to electricity as the handmaid of all forms of modern industry, and suggested that there was hope "even for the railways" if they would get busy with electrification. Mr. W. B. Woodhouse, past president, proposing a toast to "Yorkshire Industries," said the country had been fortunate in its possession of so many and varied natural resources and so many men of industrial experience. Yorkshire had had its labour troubles, but had settled them, and anybody contemplating setting up new industries could go to Yorkshire satisfied that there both sides to the labour problem had done all they could to smooth differences. Some had started new industries in country districts in the belief that they would be free from labour problems, but in practice find themselves just at the beginning of them. Yorkshire had had industrial problems for 100 years and by now had solved most of them, because masters and men knew how to get together and face facts together.

Mr. A. J. Grant, president of the National Federation of Iron and Steel Manufacturers, said the best brains in that industry were trying to produce a scheme of reorganisation on a national basis which it was hoped would be fully formulated within the next month or so.

Lt.-Col. Kitson Clarke, replying to the toast of "The Institution of Mechanical Engineers," said a great deal of nonsense was being talked and written lately about destroying the beauty of the English landscape by electric "pylons." The country must have the service and the electrical industry was as anxious as anybody to avoid marring our countryside.

Foresight at Stoke-on-Trent

A dinner was held at Stoke-on-Trent last week at the coming-of-age of the 3-phase 50-cycle supply, which was standardised when the six Pottery Towns were amalgamated. Ald. G. Hassel (chairman, Electricity Committee), proposing the health of "The Electricity Commission," referred to the great benefit that had come to the town from its decision to bring the various systems of the component towns on to a common basis. He presented Sir John Brooke (vice-chairman, Electricity Commission) with a piece of Doulton ware as a memento of the occasion. Sir John Brooke, responding, spoke of the remarkable force and efficiency of the city engineer (Mr. C. H. Yeaman). But for the decision to standardise the system, he believed supplies could not now be given at the low rates charged in Stoke.

Ald. Sir F. Hayward proposed "The Electricity Committee," and the chairman, in reply, stated that the largest consumer was the Michelin Tyre Co., which had a 10,000-kW substation. Electric kilns with load factors of about 92 per cent. were supplied at ¼d. per kWh, quickly falling to ⅜d. Within the last few days the first pan mill had been converted to an electric drive. The running charge of the multi-part tariff was ⅜d. per kWh, the lowest of which he had any record. The experiment with sixteen all-electric houses had proved that all domestic services could be rendered cheaply by electricity. Sir Francis Joseph proposed "The N.W. Midlands J.E.A.," and Ald. H. Leese responded. "The Contractors" was proposed by Ald. S. Sproston, and responded to by Mr. J. S. Peck and Mr. H. Foulds.

The E.A.W.

Miss C. Haslett lectured to members of the Stockton and Thornaby Women's Association last week at the new electricity showrooms of the Stockton Corporation on the subject of the uses of electricity in the home. There was an influential attendance, and it was decided to form a branch of the Electrical Association for Women, Mrs. E. Mark being appointed the first president. Miss Cuttriss, the electricity showroom demonstrator, assisted at the gathering, with Mr. S. G. Marston, electrical engineer.

The annual dinner of the North-East Coast branch of the Electrical Association for Women was held at Newcastle-on-Tyne on March 7th, Miss C. Bright, the newly elected chairman of the branch, presiding. Sir Andrew Duncan (chairman, Central Electricity Board), speaking of the future of the electricity supply industry, stressed the importance of the domestic aspect of the industry, a need catered for by the Association. He also referred to the Central Electricity Board's work. Miss C. Haslett said that women must be taught not to fear electricity. The Board of Education realised that and two years ago started a school for the training of teachers in the uses of electricity. Miss N. Balls proposed the health of the guests and emphasised the need for the "pushing" of electrical domestic knowledge in rural districts.

The north-eastern branch of the Association has decided to allow membership to men, as associate members; they will take no part in the voting and administrative work of the branch, and the subscription of one guinea will be "for life."

The annual general meeting of the Rugby Branch of the E.A.W. was held on March 10th at the Rugby Works of the British Thomson-Houston Co., Ltd. The members were received by Mrs. A. P. Young, founder member and vice-president of the Rugby Branch, and entertained to tea. Afterwards they adjourned to the factory building, where washing and ironing machines are manufactured, and witnessed a demonstration of the Hotpoint-B.T.H. washing machine. After the demonstration the members proceeded with their meeting, the chair being taken by Mrs. H. de B. Knight.

Appointments Vacant

Manager for East Dereham Electricity Department.

Electrical engineer and manager for Brecon Electricity Department.

Mains assistant for Oxford Electricity Supply Department.

Distribution engineer for Torquay Electricity Department.

Electrical engineer for Simla Municipality.

(See our advertisement pages to-day.)

I.E.E. Conversazione

The Institution of Electrical Engineers has arranged to hold its annual conversazione on Thursday, June 30th.

E.P.E.A. at Barton

Barton power station was visited by 150 members of the Manchester section of the E.P.E.A. last Saturday, under the guidance of Mr. S. A. Russell (chairman of the Section and power stations engineer of Manchester Corporation Electricity Department).

The well-equipped laboratory for testing coal, oil, water, metals, &c., was first inspected, followed by the coal-handling plant with its 100-ton per hour conveyors. The boiler house now contains one h.f. fired boiler and 12 stoker-fired boilers each with an evaporative capacity of from 100,000 to 130,000 lb. per hour. In No. 2 turbine house is installed the 41,000-kW sets and in No. 1 three 27,500-kW sets. In the control room the frequency recorder and the methods adopted for time-keeping by electric clocks were of outstanding interest.

International Electrical Congress

Plans are well in hand for the International Electrical Congress, which is to be held in Paris from July 4th to 12th next, and will be officially opened by the President of France. Electrical engineers intending to take part in the Congress can obtain full details from the Société Française des Electriciens, 14, Rue de Stael, Paris, XV.

New Zealand Standards

In connection with the tour of Mr. C. le Maistre, director of the British Standards Institution, who has been sent at the request of the Board of Trade on a mission to Australia, New Zealand, and Canada, a telephone conversation with him took place recently by wireless between Wellington and London. During the conversation he stated that at a fully representative meeting in Wellington it was decided to set up a New Zealand standards organisation. This was the culmination of his visits to the four principal cities, Wellington, Auckland, Christchurch, and Dunedin, at each of which he had spoken to most appreciative audiences.

Poultry Rearing by Electricity

The electrified poultry farm is becoming a factor of increasing importance to supply undertakings in Lancashire. Recently twenty-eight members of the Manchester and Salford Branch of the Electrical Association for Women paid a visit to an all-electric farm situated at Welch Whittle, near Chorley. The farm, which belongs to Mr. W. H. Bromilow, was electrified throughout at the beginning of 1931, the Lancashire Electric Power Co. supplying the electrical energy. Last year 16,000 utility hens were produced, while the normal output per week was 3,000 chickens. After the visit the Association members were shown over the power company's new showrooms at Chorley.

Cooker Control Specification

British Standard Specification No. 438-1932, which has just been issued, covers cooker control units for use in two-wire circuits of not more than 250 volts declared pressure. The units are intended for the control of domestic electric cookers and consist of a switch for controlling the current to the cooker, together with an auxiliary circuit by means of which an iron, kettle, or other appliance, may be used simultaneously or independently of the cooker.

Copies of this specification may be obtained from the Publications Dept., British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

IRON DUKE electric irons.

Real wax candle tubes built upon papier mache or similar.

COSYWARM electric fire.

Electrical worm killer.

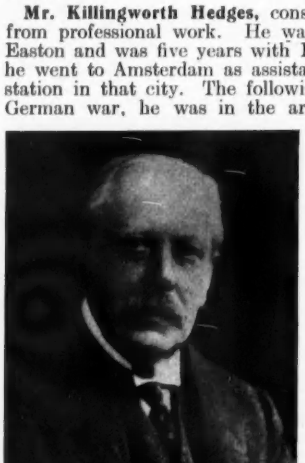
Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. N. Stephens, who has been appointed to the board of the Edison Swan Electric Co., Ltd., was a student of Finsbury Technical College in the days of Professor Silvanus P. Thompson. He was connected with the early days of so-called "free wiring" and the introduction of the oiled paper twin lead covered wiring system. During a number of years, as district manager for the National Electric Construction Co., Ltd., in London, and the provinces, he was responsible for a large number of important plant and lighting installations. He was identified with the early motor car exhibitions at the Crystal Palace, for which a large amount of temporary plant was laid down. In 1903 he joined the British Thomson-Houston Co., Ltd., in London, and for several years was engaged on the supply side, with special reference to industrial electrification. In 1910 he helped to form the Mazda lamp organisation, of which he was assistant manager, and was responsible for the planning of Mazda House, Upper Thames Street, opened in 1912, in which year he became manager of the company's lighting appliance and wiring supplies department. Since the formation of Associated Electrical Industries, Ltd., he has been actively engaged in organisation duties, especially in connection with the merging of the wiring supplies, lighting, engineering and radio sections of the B.T.-H. Co. and Metro-Vick Supplies with the Edison Swan Electric Co., Ltd. In 1930 he became personal assistant to Sir Felix J. C. Pole, chairman of Associated Electrical Industries, Ltd. Mr. Stephens is a member of the I.E.E.; he was responsible for the formation of the Electrical Accessories Manufacturers' Association (now merged in the B.E.A.M.A.), and was the first chairman of the Electric Light Fittings Association. He is a member of the Council of the E.T.B.I., and has recently been elected a vice-president of the Electrical Trades Commercial Traveller's Association.

Mr. J. N. Stephens, who has been appointed to the board of the Ediswan Co.

Mr. Killingworth Hedges, consulting engineer, has retired from professional work. He was articled to the late James Easton and was five years with Easton & Anderson. In 1870 he went to Amsterdam as assistant engineer at the pumping station in that city. The following year, during the Franco-German war, he was in the area of the German army in occupation, and was arrested, but paroled. Later he was smuggled over the frontier to Belgium. In 1872 he was appointed assistant engineer for the construction of the Colorado Springs-Pueblo section of the Denver and Rio Grand Railroad. He was the first to introduce electric lighting for docks, and in 1879 he installed Gramme dynamos and arc lamps at Liverpool docks, using hydraulic pipes for return leads. He designed the electrical installation for the s.s. *Chimboraco*, the plant for which included a Gramme dynamo and a Willans engine; lamps were used for lighting.



Mr. Killingworth Hedges, who is retiring from active work

At the Crystal Palace Exhibition of 1882 he exhibited his gravity arc lamps, while the dynamos at the exhibition were started by the Lady Mayoress, using his switch, the first commercial one. His mica fire fuses were used throughout the Vienna Exhibition of 1883, and proved so successful that he was presented with a certificate by the Technical Scientific Commission.

He designed the plant for the bakery of the Aerated Bread Co., in which motor-driven shafting was first introduced, and the first carbon works in England—at Barnsley in 1888—was commenced by him. He was consulted on the electric lighting of St. Paul's Cathedral, and rearranged the lightning conductors. He is the author of many publications on electric lighting and lightning conductors.

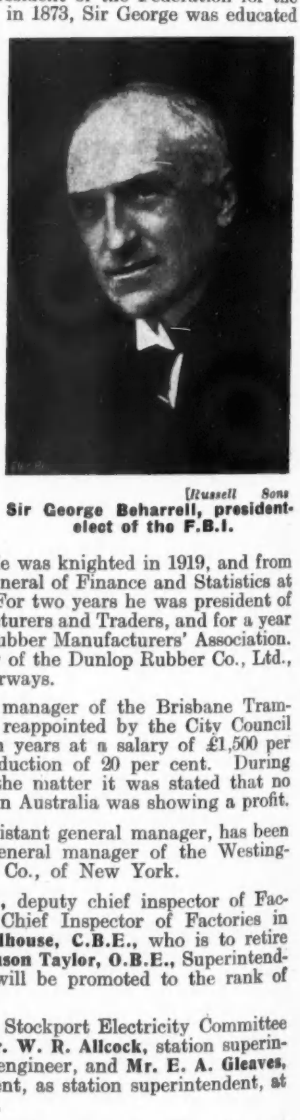
Sir Henry Fowler has been elected president of the Institute of Metals for 1932-33. Other officers are: Mr. W. R. Barclay, Dr. A. G. C. Gwyer, Professor D. Hanson, Dr. R. S. Hutton, Dr. H. Moore, Vice-Admiral Sir Reginald Skelton (vice-presidents); Mr. J. Fry (hon. treasurer); and Mr. G. Shaw Scott (secretary).

Mr. Bernard S. Lord, deputy electrical engineer to the Farnworth Urban District Council, has been appointed chief electrical engineer and manager to the Cleethorpes Urban District Council. He was recently presented by Mr. A. J. Hutchinson, engineer and manager at Farnworth, on behalf of himself and the staff with a leather attaché case and document case, as a memento of their appreciation of his service with the Department. Mr. Lord commences his duties with the Cleethorpes Council on April 1st.

Mr. J. Williamson, who is on the staff of the South African Electricity Supply Commission's power station at Durban, has been awarded the 1931 President's Prize for his paper on "Corrosion in Surface Condensers." The paper was read before the Association of the Certified (S.A.) Mechanical and Electrical Engineers.

Mr. M. I. Lipman, A.I.E.E., late production engineer to E. K. Cole, Ltd., has taken up the position of works manager to Zetavox Radio and Television, Ltd., Cricklewood.

Sir J. George Beharrell has been nominated by the Grand Council of the Federation of British Industries to succeed Sir James Lithgow, Bart., as president of the Federation for the coming year. Born at York in 1873, Sir George was educated at Almondbury, Yorks, and Leeds University. Entering the service of the North Eastern Railway, as it then was, he became assistant to the general manager, and assistant goods manager and commercial agent. After a short period as Director of Statistics and Requirements at the Ministry of Munitions, he went to France as Assistant Director General of Transportation. Later he became Assistant Inspector of General Transportation for all the theatres of war with the rank of lieutenant-colonel. In 1917 he received the D.S.O. Towards the end of the war he became Director of Statistics at the Admiralty, and was attached to the Geddes Committee on National Expenditure in 1921-1922. He was knighted in 1919, and from 1919 to 1922 was Director General of Finance and Statistics at the Ministry of Transport. For two years he was president of the Society of Motor Manufacturers and Traders, and for a year was president of the India Rubber Manufacturers' Association. He is now managing director of the Dunlop Rubber Co., Ltd., and a director of Imperial Airways.



Russell Sons

Sir George Beharrell, president-elect of the F.B.I.

Mr. G. R. Steer, general manager of the Brisbane Tramways Department, has been reappointed by the City Council for a further period of seven years at a salary of £1,500 per annum, less a temporary reduction of 20 per cent. During the Council's discussion of the matter it was stated that no other tramway undertaking in Australia was showing a profit.

Mr. George H. Bucher, assistant general manager, has been elected vice-president and general manager of the Westinghouse Electric International Co., of New York.

Mr. D. R. Wilson, C.B.E., deputy chief inspector of Factories, has been appointed Chief Inspector of Factories in succession to **Sir Gerald Bellhouse, C.B.E.,** who is to retire on April 13th. **Mr. G. Stevenson Taylor, O.B.E.,** Superintending Inspector of Factories, will be promoted to the rank of Deputy Chief Inspector.

At a recent meeting of the Stockport Electricity Committee it was resolved to appoint **Mr. W. R. Allcock,** station superintendent, as deputy electrical engineer, and **Mr. E. A. Gleaves,** assistant station superintendent, as station superintendent, at the appropriate grade salary.

Mr. E. Yeeles has been nominated by the Committee of the North-Eastern Students' Section of the Institution of Electrical Engineers as chairman to serve next session, and **Mr. O. A. Chrisp** has been nominated as vice-chairman.

Mr. Ronald Birt, junior assistant engineer at Ealing, has been recommended by the Electricity Committee for the post of chief assistant electrical engineer at a salary of £450.

Mr. Charles H. Merz, of Messrs. Merz & McLellan, is now in South Africa revisiting the various clients of his firm. He is accompanied by Mrs. Merz and his daughter, Miss Helen Merz.

Mr. Matthew Somerfield, assistant transport manager, has been appointed transport manager of the Walsall Corporation undertaking at a salary of £1,000 per annum.

Mr. H. J. Fraser, of Liverpool, was recently married to Miss E. Smethurst, of Aintree. Mr. Fraser is an old student of Liverpool University and received his workshop training at the Dick Kerr works of the English Electric Co., Ltd., Preston. He is now an assistant engineer with the Yorkshire Electric Power Co., Leeds.

The Brisbane (Q.) *Daily Mail* reports that **Mr. J. W. Davidson** has been appointed chairman of the newly created State Transport Board. The members of the board are: Messrs. J. R. Kemp (Main Roads Commissioner), E. E. Forth (J. C. Hutton & Co.), A. S. Douglas, and W. J. Low (private secretary to the Minister for Transport, who will be secretary to the Board in addition to being a commissioner). The Board is to make a survey of transport generally and recommend to the Government the policy to be adopted in the co-ordination of the various transport services of the State.

Obituary

Mr. W. F. Haldane, whose death was reported in our issue of March 4th, was born at Armagh in 1885, and received his early education in the Armagh Royal School, and his technical training at the Manchester Technical College, after which he served his apprenticeship with the Rhodes Motor Co. Subsequently he went to Canada to install some of that company's plant, and worked for some years on transmission line construction for the Canadian General Electric Co., and afterwards as a mining electrical engineer. He joined the Canadian Expeditionary Force during the war and suffered the loss of a leg at Ypres. In 1918 he joined the B.T.-H. Co., and shortly afterwards went to Dublin as assistant to Mr. Handcock, manager of the Dublin office. When Mr. Handcock left the company in 1922, Mr. Haldane became manager of the Dublin office, and he was also made manager of the Belfast office when that was opened in 1923.

Mr. J. Fielding.—The death is announced in *The Times* of Mr. John Fielding, M.Inst.C.E., M.I.Mech.E., which occurred on March 2nd at Broadsground, Upton St. Leonards. He was 82 years of age.

Will.—Mr. J. T. Murray, late partner in Messrs. Lewin and Murray, electrical engineers, Halifax, left £21,422 (net personalty £20,620).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Radio-Tricity, Ltd.—Private company. Registered March 9th. Capital £1,000 in £1 shares. Objects:—To carry on the business of wireless and electrical engineers and contractors, manufacturers of and dealers in wireless sets, electrical apparatus, &c. The directors are:—A. Polkinhorn, "Duloc," Withdean Crescent, Brighton; V. W. Budgen, 71, Southover Street, Brighton; F. V. Hole, 40, Luther Street, Elm Grove, Brighton; and L. R. Winter, address not stated. Registered office: 150, North Street, Brighton.

Envoy Electrical Storage, Ltd.—Private company. Registered March 9th. Capital £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in electrical accumulators, batteries, dynamos, motors, and electrical plant, &c. The directors are:—R. W. Mallaby, 14, Middleton Crescent, Dewsbury Road, Leeds; and G. Fisher, The Moorings, Harrogate Road, Leeds. Solicitors: Armitage Speight & Ashworth, Leeds.

R. H. Clampett & Co., Ltd.—Private company. Registered March 10th. Capital £1,000 in £1 shares. Objects:—To acquire the business of an electrical engineer and contractor carried on by R. H. Clampett as R. H. Clampett & Co. at 13, Paton Street, Piccadilly, Manchester. Directors:—R. H. Clampett (managing director) and Mrs. E. Clampett, both of 21, Willoughby Avenue, Didsbury, Manchester. Registered office: 13, Paton Street, Piccadilly, Manchester.

Regent Radio, Ltd.—Private company. Registered March 14th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio and electrical goods and appliances of all kinds, &c. The subscribers are: A. Wilson, 62, Myddelton Square, E.C.1, and H. B. Ravilions, 22, Hillcrest Road, W.3. Solicitors: Zeffertt & Heard, 17, Coleman Street, E.C.2.

Returns of Electrical Companies

Pernambuco Tramways and Power Co., Ltd.—Satisfaction to the extent of £500,000 on January 1st, 1929, of trust deed to secure 8 per cent. prior lien debentures dated July 15th, 1921, and registered July 22nd, 1921. (Notice filed March 9th, 1932). (According to the register of mortgages, £500.000 was the full amount secured by the trust deed registered July 22nd, 1921.)

International General Electric Co. (New York), Ltd.—Capital, £100,000 in £1 shares. Return dated December 31st, 1931 (filed March 9th, 1932). 25,100 shares taken up. £25,100 paid. Mortgages and charges, nil.

Harvey (Electrical Engineers), Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1932. 200 shares taken up. £200 paid. Mortgages and charges, nil.

All Electric House Co., Ltd.—Capital £3,000 in £5 shares. Return dated October 15th (filed November 11th), 1931. All shares taken up. £2,975 paid. £25 calls unpaid. Mortgages and charges: Nil.

General Gas & Electricity Co., Ltd.—Capital £200,000 in 47,000 6 per cent. redeemable preference and 145,000 ordinary shares of £1 and 160,000 deferred ordinary shares of 1s. each. Return dated January 5th, 1932. 23,550 preference, 77,912 ordinary and 79,300 deferred ordinary shares taken up. £104,977 paid (being £1 per share on 23,550 preference and 77,412 ordinary, 2s. per share on 500 ordinary and 1s. per share on 79,300 deferred ordinary). Mortgages and charges: Nil.

J. R. Halliwell, Ltd.—Capital £1,000 in £1 shares. Return dated December 15th, 1931. 425 shares taken up. £425 paid. Mortgages and charges: Nil.

Radio Retailers, Ltd.—S. G. Crimes, 150, Southampton Row, W.C.1, was appointed receiver and manager on February 25th, under powers contained in debentures dated August 25th, 1930.

Davey Paxman & Co., Ltd.—H. F. Kemp, 36, Walbrook, E.C., was appointed receiver and manager by Order of Court dated February 26th, but not to act as manager for more than three months from the date of the Order without leave of the Court.

Potteries Electric Traction Co., Ltd.—Particulars have been filed of second debenture stock for £100,000, authorised January 29th, 1932, and covered by trust deed of same date, the whole amount being now issued. Property charged: the company's undertaking and property, present and future, including uncalled capital (subject to trust deed dated July 26th, 1900). The trustees are the Electrical and Industrial Investment Co., Ltd.

Plessey Co., Ltd.—Debenture dated February 10th, to secure £35,000, charged on land at Ilford, and the company's undertaking and other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd. Satisfaction in full (1) on February 20th, of debenture dated August 29th, 1930, and registered September 5th, 1930; and (2) on February 23rd, 1932, of debenture dated March 16th, 1927, and registered April 5th, 1927. (According to the register of mortgages, the debenture registered September 5th, 1930, originally secured advances up to £6,000, and debenture registered April 5th, 1927, originally secured all moneys due to bank.)

City Notes

Allgemeine Elektricitäts Gesellschaft.—The report of the directors for the year ended September 30th, 1931, states that new construction is almost completely at a standstill, while only urgent requirements are being met.

As a consequence the company's turnover declined to 370 million marks or by about 30 per cent. as compared with 1929-30. The decrease in the orders booked and in the stock of orders on hand at the end of the financial year was in about the same proportion.

Home business fell off to a comparatively greater extent than export trade, and foreign orders now on hand actually exceed the inland orders. In absolute values, however, the export trade last year was 20 per cent. below that in 1929-30. In the current financial year there has been a further diminution in business, although the losses on working have decreased. As a result of the shrinking market and the excess productive capacity of the electrical industry, the sale prices of manufactures further declined, and customers have been compelled in an increasing measure to ask for long-term credits.

Efforts have been made to counteract the diminution in sales and prices by constant improvements in manufacturing, by large expenditure on works of research and development and by reducing the costs of production. It was impossible, however, to adapt wages and salaries sufficiently quickly to the decline in turnover. Short-time working was introduced, but it was found necessary to discharge a large number of workmen and to pension others. During 1930-31 the total number employed was reduced from 50.000 to 40,000, and since then the number has further fallen to 38,500.

In conjunction with the Siemens-Schuckert Works the A.E.G. acquired the Maffei-Schwartzkopff Works during the year and took up further shares in the Bergmann Electricity Company. In association with the firm of A. Borsig the company established the Borsig Locomotive Works, which now takes a good share of orders placed by the Reich railways. Further shares were acquired in the National Automobile Company.

In Spain the company jointly with the Société Générale de Constructions Electriques et Mécaniques, of Paris, the Compagnie Française Thomson-Houston, of Paris, the International General Electric Co., of New York, and a Spanish group, formed a sales company with a capital of 20,000,000 pesetas; it also participated with the same group in an electro-technical works (the General Electrica Espanola, S.A., of Bilbao), which has a capital of 10,000,000 pesetas.

The turnover of the Standard Elektricitäts Gesellschaft con-

siderably declined owing to the reduction in the orders from Government and other authorities. The trade of the Telefunken Company in broadcasting apparatus in 1930 remained at about the same level as in the previous year, although it fell considerably in the final months of the year. The undertaking of the Transradio Gesellschaft was taken over by the Post Office on January 1st, 1932. A favourable development of sales has taken place in the case of the Klangfilm Company and new markets have been opened up by the introduction of new apparatus.

The accounts for 1929-30 showed net profits of 14.23 million marks and a dividend of 7 per cent. was paid on the ordinary shares. For 1930-31 the accounts record gross profits of 15.08 million marks, but the precise amount of the loss (which is met from reserves) does not appear to be definitely mentioned. The ordinary share capital in the new form of balance-sheet stands at 185 million marks as compared with 200 millions a year ago. The annual general meeting takes place on March 22nd.

The County of London Electric Supply Co., Ltd., reports a balance of £1,397,687 for the year ended December 31st last, after deducting operating costs, &c., as compared with £1,308,594 in the preceding year; to this is added £447,992 brought in and interest charged to capital (Barking supply) of £7,415, making £1,853,094. After deducting debenture interest, &c., and placing £25,000 to taxation reserve and £424,447 to depreciation reserve, there is a balance of £1,137,864. It is proposed to pay a final dividend of 7½ per cent. on the ordinary shares, making 10½ per cent. for the year (against 11 per cent. for 1930), leaving £464,370 to be carried forward. The capital expenditure during the year amounted to £1,286,042, the chief items of which were £637,076 for mains, £287,761 for buildings, &c., and £84,891 for machinery. The report states that applications received (including bulk and railway supplies) amounted to 55,281 kW, making a total of 440,053 kW. The sales of electricity amounted to 509,528,914 kWh, an increase of 62,040,054 kWh for the year, and the number of consumers supplied directly or indirectly showed an increase of over 44,000, making a total of over 246,000. Reductions in the charges under the two-part tariffs were made at the beginning of the year in certain areas. In pursuance of the provisions of the London Electricity (No. 1) Act, 1925, the company fixed the standard prices which are to operate as from January 1st, 1932, and these prices are still under examination by the authorities. Application has been made for a Special Order to acquire the undertaking authorised by the Maldon and District Electricity Order, 1925; the area of supply under this Order will form an addition of 16 sq. miles. Despite wayleave difficulties, satisfactory progress has been made in Essex and a supply is now available in 50 districts. The principal contracts in respect of the extension of the Barking power station by a further 150,000 kW have been placed and considerable progress has been made. It is anticipated that preliminary trials in connection with the two new 75,000-kW sets will be made during the autumn of 1932. The company's stations at Barking and Wandsworth are not yet operating as "selected" stations, but temporary arrangements have been entered into for affording supplies to the Central Electricity Board. The associated companies continue to show increased progress. The report records the death of Sir Harry Renwick, chairman and managing director. Meeting: March 22nd.

The Enfield Cable Works, Ltd., held its annual meeting on March 11th, the Earl of Verulam (chairman) presiding. In presenting the report and accounts (ELEC. REV., March 4th, p. 365) the chairman said that although the profit for the year under review showed a drop of 25 per cent. they had secured at least as fair a share of the business going as they had obtained in former years. The rate of profit on their turnover had been well maintained. Purchases throughout the country of the kind of cable which they manufactured fell in 1931 by at least 20 per cent. and business in 1931 showed a contraction of 36 per cent. as compared with 1929. Interest and dividends on investments were £5,000 less than in the preceding year owing to the disposal of a holding in another cable company during the year and reinvestment of the money in gilt-edged securities. With regard to the subsidiary companies, the rolling mills company had again had another good year and had paid a dividend of 10 per cent., but the Australian subsidiary had had a poor year and had made a loss, against a profit in 1930. Trade with Australia was still as difficult as it was last year, and the prospects for 1932 were still uncertain. Regarding the future, there was to-day a distinct recovery of confidence in this country, but corporations and electricity supply undertakings who were their main customers were not yet launching out on new schemes for capital expenditure. There was not yet much improvement in the European situation, but they had in their reserves all that was necessary to take advantage of the first signs of returning prosperity.

The Kensington and Knightsbridge Electric Lighting Co., Ltd., held its annual meeting on March 10th, Col. R. E. Crompton (chairman) presiding. In presenting the report and accounts (ELEC. REV., March 4th, p. 365), the chairman said that the indications in the early part of the year under review that the sale of electricity would be much above the normal did not hold, for the latter part was affected by economies by consumers and the unusually mild and bright weather. In spite of this the advance in electricity sold and revenue had been well up to the average. The board had decided to capitalise and distribute a share bonus equivalent to 23 per cent. to ordinary shareholders. The bonus shares would rank *pari passu* with the ordinary shares and would absorb £73,025, leaving a balance of free reserves amounting to £3,820. Under the 1925 Act the new standard prices would become operative as from January 1st last; their estimate of these prices would have to be submitted to the London and Home Counties J.E.A. for approval. The report and accounts were adopted.

The Scottish Power Co., in its report for the year ended December 31st last, states that the trading profits of the undertakings owned and operated by the company, together with interest during construction of the Grampian hydro-electric works (£17,788), amounted to £367,398 (as against £301,733 in 1930), and after payment of income tax, to £332,605. Out of the profits an aggregate amount of £82,854 (last year, £62,202) was reserved or carried forward in the accounts of these undertakings. The balance at credit of net revenue account, including £5,380 brought forward, amounted to £241,051 (£203,086), and after paying loan interest, &c., the balance is £192,654. The directors propose a dividend on the ordinary shares of 8 per cent. for the year, less tax (same), and £6,339 is carried forward. The Tummel development is expected to be completed by the end of 1933. The Tummel works on their completion will become revenue producing, as additional supplies to the extent of over 52,000,000 kWh per annum have been contracted for in advance. 25,250 ordinary shares of £1 each, fully paid, were issued during the year in settlement of the outstanding issued share capital of the Ross-shire Electric Supply Co., Ltd. Further issues of capital will be required in due course to meet expenditure on the above works and for other capital purposes. A resolution to increase the share capital to £5,000,000, by the creation of 800,000 £1 shares, will accordingly be submitted to the shareholders at the annual meeting to be held to-day (Friday).

Lancashire Dynamo & Crypto, Ltd., reports a profit for 1931, after charging depreciation and debenture interest, of £5,391, as compared with £7,691 in the preceding year; to this is added £7,323 brought in, making £12,714. It is proposed to pay an ordinary dividend of 1¼ per cent., less tax (against 2½ per cent.), and to carry forward £7,801. The report states that the profit shown is after providing in full for depreciation of the company's plant and for contingent losses abroad consequent upon unsettled world conditions. The volume and prices of orders placed indicate that trade depression was even more acute than during the preceding year. Nevertheless, the company obtained its full share of the business available. The change of the name of the company became operative on December 31st last. The object of enabling both the company and its subsidiary (the Crypto Electrical Co., Ltd.) to trade under one name and take advantage of the benefits accruing from complete amalgamation will not be realised until the current year. As a consequence, the company's holding in the Crypto Co. appears in the accounts under review. Mr. J. H. Dunbar has been elected to the board. Meeting: March 22nd.

The Telephone & General Trust, Ltd., held its annual meeting on March 11th, Mr. A. R. Wagg (chairman), presiding. In presenting the report and accounts (ELEC. REV., March 11th, p. 400), the chairman said that Telephone & Associated Services, Ltd., which commenced activities in February, 1931, had taken over the auxiliary services given by the Trust to companies in which it was directly interested. The telephone companies in which the Trust was interested were progressing satisfactorily. They were fighting the depression by intensive canvassing and educative campaigns, which had already proved a great success. The subsidiary companies all showed profits. Agreements had been entered into with the State Undertaking of Polish Posts, Telegraphs & Telephones, under which the Trust and Automatic Electric Co., Ltd., would furnish automatic telephone equipment on credit terms for the conversion of the Polish telephone network to the automatic system. The work was based on the Strowger system and the Automatic Co. would supply the equipment, over a period of six years; the total credits involved would amount to approximately £550,000. The Trust had undertaken the furnishing of these credits against satisfactory collateral security, and on a large part of the credits involved had obtained the guarantee of the Export Credits Guarantee Department of the Board of Trade. Their structure was sound, their investments good, and their management was technically of the highest character. They might look forward, therefore, to the remainder of 1932 with reasonable confidence. The report and accounts were adopted.

The London Electric Supply Corporation, Ltd.—Presiding at the annual meeting on March 15th, Mr. O. R. H. Bury (chairman) said the maintenance of the revenue was satisfactory, as the company's area was chiefly industrial and the majority of the industrial consumers were suffering from trade depression. The capital expenditure during the year of £122,729 was chiefly in connection with the change-over of their a.c., 85-cycle and 25-cycle system to 50 cycles, and the extension of distribution mains on the standard frequency. New standard prices were to be fixed to operate from January last, and the authorised dividend on the ordinary shares for the current and future years was 7 per cent. This might be increased if the company charged its consumers an average price less than the standard price. The new building in Stamford Street was nearing completion, and would include a meter testing laboratory, engineers' stores, and workshops grouped with the offices themselves. Water was heated by electrodes and then flowed into a storage tank from which it circulated through the building. The temperature of the building was automatically controlled. It was intended to use this heating apparatus for propaganda purposes. The local showrooms and offices for the New Cross, Deptford, and Brockley area had been completed and opened at Lewisham High Road. The report and accounts were adopted.

The Clyde Valley Electrical Power Co. held its annual meeting on March 15th, Mr. C. Ker presiding in the absence of Sir Frederick C. Gardiner (chairman). In presenting the report and accounts, Mr. Ker said that the expenditure of £171,340 during the year was largely in connection with the extensions of the boiler house at Yoker. With the new plant at Yoker power station now in full service, and with the closing down of Motherwell power house, they hoped for greater efficiency and lower generating costs. The revenue from the sale of electricity was down by £108,000 as compared with the preceding year, the shipyards being responsible for 33.96 per cent. of the reduction. The suspension of work on the Cunard steamer at Clydebank meant a reduction in output of between 6,000,000 and 7,000,000 kWh per annum. The decrease in industrial use had been to some extent offset by increased consumption by shop and domestic consumers. The domestic load showed a steady increase, and they had now connected to their own system some 50,000 consumers of this class. Last year nearly 8,000 new customers were connected, a large percentage of which were converted from gas supply. The assisted wiring

scheme had made steady progress, and the number of houses so wired had doubled itself each year since the commencement of the scheme. They had introduced during the past year a simplified scheme for the smaller type of houses. Under agreement with the Lanark County Council they had taken over the supply of electricity in Cambuslang area, and the old steam generating station was now closing down. They were about to complete a new agreement for supply over the whole County of Lanark. The report and accounts were adopted.

The Charing Cross Electricity Supply Co., Ltd., reports that the net earnings of the West-End Undertakings for 1931 were £150,657, as compared with £151,685 in the preceding year. After providing for debenture interest, &c., it is proposed to pay a final ordinary dividend of 10 1/16d., making the standard dividend for the year, to transfer £28,514 to reserve for shareholders' proportion of consumers' benefit, and to appropriate £5,969 to co-partners, leaving £94,251 to be carried forward. The total connections increased from 40,093 to 42,737 kW. The City Undertaking's accounts show net earnings of £137,491. The ordinary dividend is 10 per cent. on £350,000 and 7 per cent. on £200,000. Shareholders' proportion of consumers' benefit is £13,628, and £6,306 is appropriated to co-partners. It is proposed to capitalise £110,371 of the reserves and to make a further distribution of one share in ten.

The Lisburn Electric Supply Co. has declared a dividend of 5 per cent., less tax, for the year. At the annual meeting on March 9th the chairman said that the number of consumers was steadily increasing, while the average price charged for kWh had been reduced from 4.62d. per kWh in 1930 to 3.95d. per kWh in 1931. The authorities had approached the company with a view to purchasing a portion of the line common to the supply of Dunmurry, Lambeg, Lisburn, Lurgan and areas beyond Lurgan. An agreement as to the conditions of supply and the price to be paid had been reached, and the necessary financial arrangements were now being completed.

Cammell Laird & Co. report a loss for 1931, after providing for depreciation and debenture interest of £41,367, as compared with a profit of £28,083 for 1930. This is deducted from the amount brought in, leaving £1,288. Meetings of holders of the various securities are to be held on March 23rd, when proposals will be submitted for writing down the assets by £3,501,856, the issued share capital being reduced from £4,459,285 to £957,429. The scheme is supported by a committee of holders of the two debenture stocks concerned, and is recommended by Sir William McLintock, of Messrs. Thomson, McLintock & Co., who investigated the financial position of the company.

The Cambridge Electric Supply Co., Ltd., reports a balance of net revenue account, including the amount brought forward, of £30,332, as compared with £31,920 in the preceding year. It is proposed to transfer £7,000 to reserve, to allocate £1,500 to the staff benevolent fund, to write off the cost of increase of capital (£2,014), and to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year, leaving £2,752 to be carried forward. During the year, vacancies on the board were filled by the appointment of Mr. A. Winterbottom and Major G. H. G. M. Cartwright. Meeting: April 6th.

The City of London Electric Lighting Co., Ltd., reports a profit for 1931 of £350,859, as compared with £332,012 in the previous year, to which is added £10,184 brought in, interest on investments, &c., making £373,587 (£356,145). From this is deducted debenture interest, &c., and £35,920 paid under protest for local rates, and now the subject of an appeal. It is proposed to maintain the standard ordinary dividend (10 per cent. per annum), to transfer to special reserve the company's share of consumers' benefit (£57,603), and to appropriate to co-partners £48,608.

The Isle of Thanet Electric Supply Co., Ltd., reports a revenue for 1931 of £169,994, as compared with £177,615 in 1930, and expenses of £101,575 (£105,482). After providing for debenture interest and income tax, transferring £30,000 to general reserve, and adding interest received (£358) and a balance of £8,783 brought in, there is a sum of £28,560 available. It is proposed to pay an ordinary dividend of 4 per cent., and to carry forward £28,560. Meeting: March 21st.

The Newcastle and District Electric Lighting Co., Ltd., reports a gross profit for the year ended December 31st last of £67,252, as compared with £70,267 in 1930, to which is added £15,044 brought in, making £82,295. After deducting debenture interest and transferring £20,700 to depreciation and £5,000 to general reserve, it is proposed to pay a dividend of 7 per cent., less tax (same), and to carry forward £15,323. Meeting: To-day (Friday).

Grosvenor Electric Batteries, Ltd.—At an extraordinary general meeting held in London on March 9th, Mr. L. S. M. Wells presiding, accounts for the six months ended December 31st, 1931, were submitted showing a net profit of £8,208, plus £1,897 brought forward. After reserving an amount for income tax and preference dividend due at December 31st, the balance of £8,737 was available for carrying forward.

Pinchin, Johnson & Co., Ltd., report a profit of £272,018 for 1931, as compared with £391,323 in 1930, to which is added £31,781 brought in making £53,799. Income tax absorbs £76,000, and it is proposed to pay a final ordinary dividend of 7½ per cent., making 17½ per cent. for the year, leaving £65,736 to be carried forward. The carry-forward includes £25,000 transferred from capital profit on sterling.

The International Telephone and Telegraph Corporation reports a net consolidated income equivalent to 120 cents per share on the 6,400,206 shares of capital stock. The directors have decided that in view of the continued low level of business generally throughout the world, &c., no dividend action should be taken at this time. A year ago a quarterly dividend of 50 cents per share was paid.

The Mersey Power Co. in its report for 1931 reports a working profit of £88,546, as compared with £90,222 in the preceding year. It is proposed to maintain the ordinary dividend at 5 per cent. and to carry forward £14,199. The report states that the sales of electricity for industrial purposes declined by six million kWh, but this was partly compensated for by an increase in the sales for domestic purposes.

The International Hydro-Electric System has declared the regular quarterly dividend of $0.87½ per share on the preferred stock, convertible $3.50 series, and a quarterly dividend on the class "A" stock of 1/50th of a share of Class "A" stock for each share of such Class "A" stock held, or cash at the rate of 50 cents for each share held.

The Yorkshire (West Riding) Electric Tramways Co., Ltd., reports a net income, including subsidiaries' earnings, of £28,664. The available balance is £34,676, and it is proposed to transfer to reserve £600 in lieu of workmen's compensation insurance, to expired capital outlay depreciation £15,414, and to carry forward £8,253.

Waste Heat & Gas Electrical Generating Stations, Ltd., report a profit for the year ending January 31st last of £29,714. As announced in our last issue the final dividend is 5½ per cent., making 8 per cent. for the year, the carry forward being £23,899.

Waygood-Otis, Ltd., have declared a final dividend of 2½ per cent., making 10 per cent. for 1931. In addition, it is proposed to pay a special bonus dividend of 10 per cent. The total distribution for 1930 was also 20 per cent.

Sir William Arrol & Co. report a profit for 1931 of £62,314, as against £62,895 in 1930. Reserve receives £25,000 and the ordinary dividend is 15 per cent. (against 10 per cent). The amount carried forward is £22,302 (£20,540).

The Metropolitan Railway Co.—It is reported that the issue of £2,000,000 of five per cent. redeemable debenture stock, offered at 97½ per cent. was heavily over-subscribed.

British Insulated Cables, Ltd., have declared a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year (same).

The Chelsea Electricity Supply Co., Ltd., has announced a final dividend of 10.866d. per share on the ordinary shares, making the standard dividend for the year.

The Brompton and Kensington Electricity Supply Co., Ltd., has declared a final ordinary dividend of 10.4694d., making the standard dividend for the year.

The Midland Electric Corporation for Power Distribution, Ltd., has declared a final dividend of 5½ per cent., less tax, making 8 per cent. for the year on the ordinary shares (same).

The Anglo-American Telegraph Co. proposes to pay an interim dividend for the quarter ending March 31st next of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock.

Vickers, Ltd., have declared a dividend for the year 1931 at the rate of 5 per cent., less tax at 5s., on the ordinary shares.

Stocks and Shares

Tuesday Evening.

DRAMATIC events have followed each other quickly in the financial world during the past week. Reduction of the Bank Rate to 4 per cent. was in accordance with general anticipation, but it had been expected to galvanise business, and to bring in fresh buyers of gilt-edged securities. What actually happened was that the reduction led to such a wave of profit-taking on the part of people who had previously bought British Government and similar securities, that prices underwent an all-round fall. On top of this came news of the sudden death of Mr. Ivar Kreuger, with its international repercussions; and, in addition, a good deal of talk of possible financial difficulties in the city houses. The little rush of new issues which had occurred became checked. Premiums that developed upon the new stocks gave way abruptly from their best prices. But the reaction was short-lived. A fresh wave of buyers appeared, whose purchases restored the greater part of the previous losses.

Gilt-edged Stocks

The Metropolitan Railway's new issue of 5 per cent. debenture stock, offered at 97½, attracted substantial over-subscription. The security, as mentioned here last week, is not so good as that of the recently issued Metropolitan District new debenture, but this did not affect the stags' intention. Dealings in the Metropolitan debenture started on Monday in this week, and the price, after opening at ¾ premium, hardened up to 1¼ premium. The Metropolitan District 5 per cent. stock rose to 3⅜ premium before it lost half of the fraction. Central Electricity 5 per cent. debenture was in demand at 4¼ premium, reacting later to 4 premium. The impression prevails that the decline in Bank Rate will go still further. The interest now allowed by the banks on money left with them on deposit is so small as to render its acceptance undesirable by many people to whom the interest on their money is a matter of income importance.

The ordinary stocks of the tube railway companies show no alterations. Metropolitan ordinary and Districts remain dull on account of the new issues of stock, while Undergrounds at 19s. are marking time. While the controversy rages, as it is doing now, round the London Passenger Transport Bill, there is not much encouragement for either investors or speculators to take an interest in the shares of the Underground companies.

New Issues

The Scottish Power Company has called a meeting for Friday this week for the purpose of increasing the share capital to £5,000,000 by the creation of 800,000 shares of £1 each. The money is required for expenditure on the

Grampian scheme. The works are due to be completed by the end of next year, and should become revenue-producing without delay.

The Shropshire, Worcestershire and Staffordshire Electric Power Company has just placed £1,800,000 of five per cent. debenture stock, dated 1952-1982, at about 94. Dealings are expected to start after Easter. Ahead of this stock stands the company's £621,775 5½ per cent. first debenture stock, and this the company intends to repay, when the new 5 per cent. stock would become a first charge, subject only to the £666,706 Trade Facilities Loan.

Home Electricity Supply

Amongst the electricity supply companies that are capitalising their reserves, and whose announcements have been made within the past few days, are the Kensington & Knightsbridge and the Charing Cross. Some of the prices of the home electricity supply shares are quoted ex dividend. It will be noticed from our tables that this gives the quotations a cheaper appearance. The shares are therefore likely to be singled out for attention by the capitalist, large and small, who requires security with a fair prospect of quiet capital appreciation in the value of his holdings. The Kensington & Knightsbridge share bonus is equivalent to 2¾ per cent., which is to be distributed to all ordinary shareholders. The new shares will rank *pari passu* with the ordinary shares as regards dividends in the current twelve months. At 30s. 9d. ex dividend the price shows a rise of ¼ on the week. The City of London will give one bonus share for every three old shares held, the distribution to be made next December. The Charing Cross Electricity Supply bonus is one share in ten, and the old shares at 31s. are a florin up on the week. County of London are unchanged at 44s. 6d. The company reduced its dividend, by the fraction of 10s., to 10½ per cent., in spite of the fact that the profits for last year showed an increase of nearly £90,000. But the dividend is paid on an increased capital, for the ordinary shares that were issued in December, 1929, now rank for the full dividend.

The rises recorded last week in the group of Home electricity shares have been supplemented by a fresh forward movement, and it will be noticed by reference to the table that there is again an unbroken list of improvements, ranging from 6d. to 2s. 6d. per share.

Falls in Dollar Stocks

The death of Mr. Ivar Kreuger upset the foreign and American Stock Exchanges more than it did that of London. Paris, Brussels and New York were all sellers of their particular favourites. Brazilian Tractions fell 1¼ to 16¾. The sharp rises shown a week ago in Mexican issues have received something of a check. Canadian and American utilities came on offer. Shawinigan common shares eased off to 29, after being two or three points higher. Amongst American cable issues, Internationals fell to 12 on the weakness occasioned in New York by the suicides of Mr. Kreuger and Mr. George Eastman. The passing of the dividend on International Telephone and Telegraphs turned out to have been discounted, and the price remained at 14 on the announcement, the subsequent fall being due to the tragedies just mentioned. American Telephone & Telegraph shares dropped 13 to 170, ex the quarterly dividend of 2¼ dollars.

Cables and Wireless

The market in Cables & Wireless shares has been erratic. Prices dropped sharply, as mentioned last week, upon the announcement that there would be no dividend for the 5¼ per cent. preference stock in respect of 1931. That this has been anticipated, and that bear sales had taken place in advance, was indicated by a prompt recovery in prices, which left the preference and both classes of ordinary better on the week. To speculators, the fact of these stocks receiving no dividend has the advantage of leaving future prospects a matter of lively possibility. There is persistent talk of a probable rapprochement between the Post Office and the Cables combine. It will be noticed that £100 of each of the three classes of stock can now be purchased for £80. Anglo-American Telegraph deferred stock is ¼ higher at 23½, and the preferred has moved up to 96. Marconi Marines remain dull on the decrease in the dividend. On the other hand, Great Northern Telegraphs held their 30s. rise of last week, remaining at 24, in spite of the disturbance caused to Swedish investments by the death of the Match King. Globe Telegraph & Trust preference recovered 10s. to 7.

Equipment and Manufacturing Shares

British Insulated ordinary strengthened to 59s. 6d. upon the announcement of a final dividend of 10 per cent., making 15 per cent. for 1931. This is the same rate as that of a year ago, and the result is considered distinctly satisfactory. The Enfield dividend is to be maintained, as already announced, at 25 per cent., and the price of the shares at 3¼ ex 3s. dividend shows no change, allowing for the deduction. British Aluminium have gone back to 27s. 6d., and Ever Ready shares to 24s. Henleys are ½ down at 5⅝. The other changes in the group are mostly insignificant. In the iron and steel market Babcocks receded to 45s., showing a fall of a florin, and Vickers are dull at 7s. 3d. in spite of the dividend announcement of 5 per cent. on the ordinary shares. This goes against 8 per cent. in the four years preceding. The market as a whole being dull, Vickers moved in sympathy with the rest. Rubber is uninteresting and the share prices are depressed.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price. Mar. 15.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES						
Bournemouth and Poole	1	15	15	62/–	+5/–	4 16 9
Brompton Ordinary	1	8½	8½	27/6	+1/–	5 1 10
Central Electricity 4½% Deb.	Stock	4½	4½	93½	+1	4 16 3
Charing Cross Ordinary	1	8¼	8¼	31/–	+2/–	4 10 4
Chelsea	1	8½	8½	25/6	—	5 9 10
City of London	1	10	10	37/–	+⅛	5 8 1
Clyde Valley	1	8	7	30/–	—	4 15 0
County of London	1	11	10½	44/6	—	4 14 5
Edmundsons' 7% Pref.	1	7	7	24/6	—	5 14 2
Elec. Dis. Yorkshire	1	9	9	34/6xd	—	5 4 4
Elec. Supply Corporation	1	11	—	45/–	—	4 17 9
Kensington Ordinary	1	8	8	30/9xd	+½	4 11 1
Lancs. Light and Power	1	6½	—	24/6	—	5 6 1
London & Home Counties 4½% Deb.	Stock	4½	4½	94½	+2½	4 15 3
London Electric	1	9	9	28/–	+6d.	5 0 0
Metropolitan	1	10	10	40/9xd	–6d	4 18 2
Midland Counties	1	7	7	28/9xd	+6d.	4 17 5
Mid. Elec. Power	1	8	8	29/6	+9d.	5 8 6
Newcastle-on-Tyne Ordinary	1	6	6	24/6	—	4 18 0
Do. 7% Pref.	1	7	7	26/6	+6d.	5 5 8
Northampton	1	10	10	39/6	+¼	5 1 3
Notting Hill 6% Pref.	10	6	6	10½	—	5 14 3
North Met. Elec. 6% Pref.	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	29/6	—	4 15 0
Scottish Power	1	8	—	28/9	—	5 11 4
South London	1	8½	8½	27/6	+1/–	5 1 10
Urban Ordinary	1	7	—	27/6	—	5 1 10
Westminster Ordinary	1	8½	8½	27/–	+1/–	5 3 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/–	—	6 16 4
Yorkshire Elec.	1	8	8	33/9	+9d.	4 14 10
HOME RAILS						
Central London Ord. Assented	Stock	4	4	69½	—	5 15 2
Metropolitan	„	4	3½	34½	—	10 2 10
Do. District	„	5	4½	53½	—	8 8 2
Underground Electric	1	8	7	19/–	—	7 7 4
TELEGRAPHS AND TELEPHONES.		1929.	1930.			
American Tel. & Tel.	$100	9	9	170xd	–13	5 5 11
Anglo-Am. Tel. Pref.	Stock	6	6	96	+1	6 5 0
Do. Def.	„	1½	1½	22½	+½	6 13 4
Cables & Wireless 5½% Pref.	„	5½	5½	49½	+2	—
Do. A 7½% Ord.	„	Nil	—	18½	+2½	—
Do. B Ord.	„	Nil	—	11	+1	—
Globe Tel. and T. Ord.	10	10	8½	5½	—	—
Do. do. Pref.	10	6	6	7xd	+½	8 11 0
Great Northern Tel.	10	20	20	24	—	8 6 8
Marconi-Marine	1	15	15	30/–	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅛	—	*5 16 0
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Prcf.	5	5½	—	6/3	—	—
Do. do. 2nd Pref.	5	6	—	3/9	—	—
Do. do. 5% Deb.	Stock	5	5	16½	—	—
British Electric Traction Def. Ord.	„	5	5	875	—	—
Do. do. Pref. Ord.	„	8	8	119½	+1	6 13 11
Brazil Traction	100	8	—	16¾	–1¼	5 19 5
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	87½	—	5 14 3
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/–	—	—
London United Tram Deb.	Stock	4	4	56½	+1	7 1 7
Mexico Trams, 5% Bonds	—	5	5	41½	—	12 1 0
Mexican Light Common	100	Nil	Nil	27½	—	—
Do. 7% Pref.	100	7	7	39½	–1	17 14 6
Do. 1st Bonds	—	5	5	77½	—	6 9 0
Victoria Falls Ord.	1	15	15	59/6	—	5 0 10
Yorkshire (West Riding)	1	Nil	Nil	6/3	—	—
MANUFACTURING COMPANIES						
Assoc. Elec. Ord.	1	6	6	22/6	–9d.	5 6 8
Do. Pref.	1	8	8	27/–	—	5 18 6
Babcock & Wilcox	1	15	14	45/–	–2/–	*6 4 5
British Aluminium Ord.	1	10	10	27/6	–⅛	7 5 5
British Insulated Ord.	1	15	15	59/6	+9d.	5 0 10
Brush Ord.	Stock	10	5	60	—	8 6 8
Callender's	1	15	15	58/3	–6d.	5 3 0
Do. 6½% Pref.	1	6½	6½	23/9	+⅛	5 9 5
Crompton Parkinson Ord.	5/–	30	30	18/9	—	8 0 0
Do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
Do. 5% Deb.	Stock	5	5	89½	—	5 11 10
Electric Construction	1	5	Nil	7/6	—	—
Enfield Cable Ord.	1	25	25	3¾xd	—	6 10 9
English Electric	1	Nil	Nil	10/–	—	—
Do. do. Pref.	1	Nil	Nil	10/–	—	—
Ever Ready	5/–	35	35	24/–	–9d.	7 5 10
Ferranti Pref.	1	7	7	20/9	—	6 15 0
G.E.C. Pref.	1	6½	6½	25/–	–6d.	5 4 0
Do. Ord.	1	14	10	43/9	—	4 11 5
Henley's	1	30	30	5¾	–⅛	5 11 7
Do. 4½% Pref.	5	4½	4½	4½	—	5 9 1
India-Rubber	1	Nil	Nil	5/9	—	—
Johnson & Phillips	1	10	10	22/6	—	8 17 9
Siemens Ord.	1	7½	7½	23/9	—	6 6 4
Telegraph Construction	£2	10	7½	10	—	—

* Dividends paid free of Income Tax.

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Yield p.c. £	s.	d.
4	16	9
5	1	10
4	16	3
4	10	4
5	9	10
5	8	1
4	15	0
4	14	5
5	14	2
5	4	4
4	17	9
4	11	1
5	6	1
4	15	3
5	0	0
4	18	2
4	17	5
5	8	6
4	18	0
5	5	8
5	1	3
5	14	3
5	2	2
4	15	0
5	11	4
5	1	10
5	1	10
5	3	8
6	10	4
4	14	10
5	15	2
0	2	10
8	8	2
7	7	4
5	5	11
6	5	0
6	13	4
—		
—		
—		
8	11	0
8	6	8
6	13	4
5	16	0
—		
—		
—		
6	13	11
5	19	5
5	14	3
—		
7	1	7
2	1	0
—		
7	14	6
6	9	0
5	0	10
—		
5	6	8
5	18	6
6	4	5
7	5	5
5	0	10
8	6	8
5	2	0
5	9	5
8	0	0
6	2	0
6	9	0
5	11	10
—		
6	10	9
—		
—		
7	5	10
6	15	0
5	4	0
4	11	5
5	11	7
5	9	1
—		
8	17	9
6	6	4
—		

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1930

2,496. "Electrical indicating record and integrating instruments." Lea Recorder Co., Ltd., and C. F. Clifford. October 21st, 1930. (367,399.)

6,568. "Electrolytic process for the production of metallic compounds of low solubility." Ramon R. Nadal. May 12th, 1931. (Convention date not granted.) (367,460.)

16,330. "Electric traction systems for general use in connection with battery driven motors." J. M. Fay, J. J. Drumm, and Celia, Ltd. August 16th, 1930. (367,338.)

24,683. "Electric heating apparatus." Globar Corp. August 19th, 1929. (367,403.)

27,414. "System of reproducing sound in different languages and apparatus relating thereto." S. F. Stein. September 13th, 1930. (367,383.)

31,020. "Multi-range coupling circuit for wireless signalling." Radio Frequency Laboratories Inc. September 4th, 1930. (367,409.)

33,975. "Electric lampholders." International General Electric Co., Inc. November 11th, 1929. (367,413.)

34,184. "Electrical discharge devices for the protection of transmission lines and the like from high-voltage surges." Westinghouse Electric & Manufacturing Co. November 13th, 1929. (367,350.)

34,322. "Totalisator systems." Siemens Bros. & Co., Ltd., J. H. Broom and R. I. H. Clark. November 14th, 1930. (367,355.)

34,366. "Electromechanical device for transmission of any motion at a distance, more especially intended for level-indicators of petrol or other liquids." W. W. Triggs (Soc. Amary & Poulet). November 14th, 1930. (367,418.)

34,454. "Electric rare gas illuminating lamps." A. Lederer. December 4th, 1929. (Addition to 364,088.) (367,351.)

34,488. "Signalling circuits." Electrical Research Products Inc. November 20th, 1929. (367,356.)

34,622. "Electric signalling systems for indicating deflections at a distant point." British Thomson-Houston Co., Ltd. November 16th, 1929. (367,372.)

34,719. "Battery charging systems." E. B. Perren. November 18th, 1930. (367,374.)

34,759. "Junction boxes or the like for electric cables." R. J. S. Bower. November 18th, 1930. (367,425.)

34,787. "Electric and gas lamp shade and reflector fittings." A. B. Gregson and H. Milman. November 19th, 1930. (367,391.)

34,936. "Means for obtaining constant voltage in alternating current circuits." General Electric Co., Ltd., and N. R. Bligh. November 20th, 1930. (367,430.)

34,996. "Submarine signalling cables." W. S. Smith, H. J. Garnett and J. N. Dean. November 20th, 1930. (367,435.) z

35,106. "Electric cables." Callender's Cables & Construction Co., Ltd., P. V. Hunter, L. G. Brazier and H. Hill. November 21st, 1930. (367,445.)

35,166. "Truck construction for rail vehicles." W. A. Maley and E. M. Taunton. November 21st, 1930. (367,447.)

35,180. "Photo-electric cells." Gramophone Co., Ltd., and W. F. Tedham. November 21st, 1930. (367,449.)

35,255. "Electrical generating systems applicable for the electrical propulsion of ships or other vehicles." H. G. C. Fairweather (Atlantic Refining Co.). November 22nd, 1930. (367,454.)

35,257. "Electric distribution system." H. G. C. Fairweather (Atlantic Refining Co.). November 22nd, 1930. (367,455.)

35,450. "Switching on electric signal transmission circuits." Standard Telephones & Cables, Ltd., and P. R. Thomas. November 25th, 1930. (367,469.)

35,754. "Method of and means for increasing the reliable working of metallic vapour arc discharge apparatus." L. Mellersh-Jackson (Siemens-Schuckertwerke Akt.-Ges.). November 27th, 1930. (367,475.)

35,999. "Electric gaseous discharge devices." British Thomson-Houston Co., Ltd. November 29th, 1929. (367,477.)

36,185. "Apparatus for photographically recording sound." British Thomson-Houston Co., Ltd. November 29th, 1929. (367,479.)

37,121. "Electric totalisator systems." Siemens Bros. & Co., Ltd., J. H. Broome and R. I. H. Clark. December 9th, 1930. (367,488.)

37,432. "Electric oil switches or circuit breakers." W. A. Coates. December 11th, 1930. (367,491.)

37,684. "Incandescent electric lamps." B. B. Fenn. December 13th, 1930. (367,493.)

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236. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and R. G. Dixon. January 2nd, 1931. (367,509.)

560. "Thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 26th, 1930. (Addition to 481/31.) (367,511.)

623. "Electric overload circuit-breaker installations." J. G. Statter and G. S. Marston. January 7th, 1931. (367,512.)

2,835. "Arc lamp electrodes." E. Conradty and O. Conradty (trading as C. Conradty). January 28th, 1931. (367,534.)

3,047. "Electric heaters for waving or curling the hair." I. B. Calvete. January 30th, 1931. (367,537.)

3,109. "Means for protecting electrical installations, particularly heavy current installations." Siemens-Schuckertwerke Akt.-Ges. February 10th, 1930. (Addition to 319,242.) (367,539.)

3,728. "Commutators for dynamo-electric machines." British Thomson-Houston Co., Ltd., W. W. Vinsen, and L. Griffiths. February 5th, 1931. (367,543.)

4,694. "Conduit couplings for electrical installations." J. C. Forsyth and G. C. Forsyth. February 14th, 1931. (367,556.)

4,974. "Method of, and apparatus for, performing operations such as switching operations, by means of electrically heated bimetallic combinations." Landis & Gyr Soc. Anon. February 18th, 1930. (367,561.)

7,044. "Telephone systems, such as public address systems and the like." General Electric Co., Ltd., and D. A. Oliver. March 6th, 1931. (367,578.)

7,601. "Electrodeposition of palladium." A. R. Powell, E. C. Davies, and Johnson, Matthey & Co., Ltd. March 12th, 1931. (367,587.)

7,603. "Electrodeposition of the metals of the platinum group." A. R. Powell, E. C. Davies, and Johnson, Matthey and Co., Ltd. March 12th, 1931. (367,588.)

7,939. "Methods and devices for the electro-optical reproduction of photographic sound-records." Pathé Cinema Anciens Etablissements, Pathé Frères. March 31st, 1930. (367,591.)

10,998. "Electric lamps for mines, provided with safety bells." J. G. Daloz. June 28th, 1930. (367,619.)

11,661. "Talking film installations." Radioröhrenfabrik Ges. April 28th, 1930. (367,624.)

14,413. "Metal-vapour rectifiers with anode grids arranged in the anode protecting tubes." Siemens-Schuckertwerke Akt.-Ges. April 29th, 1930. (367,648.)

15,054. "Electric regulators." International General Electric Co., Inc. May 23rd, 1930. (367,659.)

16,274. "Luminous electric discharge tubes." General Electric Co., Ltd. July 25th, 1930. (367,668.)

17,001. "Electrical contact pins." E. Kleinmann. June 11th, 1931. (367,676.)

17,003. "Electrical multiplex telegraph systems." Electrical Research Products, Inc. June 13th, 1930. (367,677.)

17,978. "Relaying systems for short wave wireless signalling." M. Von Ardenne. June 21st, 1930. (367,687.)

18,772. "Arc welding." British Thomson-Houston Co., Ltd. June 30th, 1930. (367,695.)

19,209. "Manufacture of galvanic dry cells." J. J. Pala. July 3rd, 1931. (367,698.)

20,741. "Electric control systems for web feeding apparatus." British Thomson-Houston Co., Ltd. July 21st, 1930. (367,705.)

21,577. "Sparking plugs for internal combustion engines." A. Kegresse. July 29th, 1930. (Addition to 351,340.) (367,714.)

21,750. "Electric current transformer." Landis & Gyr Soc. Anon. August 4th, 1930. (357,715.)

21,769. "Alternating current electrical instruments." Aron Electricity Meter, Ltd., and E. W. Hill, A. White, and E. Riordan. July 30th, 1931. (Addition to 14,187/30.) (367,717.)

22,100. "Process of and apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Metallges Akt.-Ges.). August 4th, 1931. (367,719.)

30,481. "Metal vapour or rare gas rectifiers." Siemens-Schuckertwerke Akt.-Ges. November 17th, 1930. (367,741.)

34,014. "Electric cables." Soc. Italiana Pirelli. December 10th, 1930. (367,744.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 9th :—

Marco (lettering and design). Nos. 521,651 and 521,652. Classes 6 and 13. Refrigerating machines. No. 521,653. Class 50. Refrigerating chests.—Marco Refrigerators, Ltd., Manor Works, Streatham Vale, S.W.16.

Mayflower (lettering and design). No. 529,345. Class 6. Electric refrigerating machines.—Trupar Manufacturing Co., Dayton, O., U.S.A. (British representatives: Frank B. Dehn and Co., Kingsway House, 103, Kingsway, W.C.2.)

Auditone. No. 528,884. Class 8. Sound producing and reproducing instruments.—E. N. Cutler, trading as the Auditone Co., 8, New Burlington Street, W.1.

Kneeling Man (design only). No. 529,177. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 519,178. Class 18. Architectural, engineering and building contrivances.—Metropolitan Electric Supply Co., Ltd., 16, Stratford Place, W.1.

Willard Thread Rubber Insulation (lettering and design). No. 524,159. Class 8. Electric batteries (not for electrical purposes).—Willard Storage Battery Co., Cleveland, O., U.S.A. (British representatives: White, Langner, Stevens, Parry and Rollinson, 5-9, Quality Court, Chancery Lane, W.C.2.)

P.S. (lettering and design). No. 525,575. Class 8. Instruments and apparatus for use in radio-telephony. No. 525,577. Class 13. Electric lamps (ordinary), terminals, electrodes and cases for electric torches.—Pala a Spol Akciova Tovarna Elektrickyce Clanku a Batterei ve Slanen, Slany, near Prague, Czecho-Slovakia. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Britram. No. 529,189. Class 13. Electric lamps (ordinary).—B. Sacov, trading as the Universal Electric Lamp Co., 61-63, Great Eastern Street, E.C.2.

Helios. No. 528,814. Class 18. Electric fires and radiators for heating buildings.—Revo Electric Co., Ltd., Tividale, Tipton, Staffs.

Shot-firing in Mines

The Secretary for Mines has made an Order to regulate the use of electrical shot-firing apparatus in coal mines. By this: (*a*) After March 31st every new exploder taken into use in any mine or part of a mine in which permitted explosives are compulsory must be of a type that has been approved by the Board of Trade. Exploders not of approved types now in use in such mines must be replaced by exploders of approved types not later than December 31st next. (*b*) The exclusive use of magneto exploders is no longer required; battery and dynamo exploders will be approved if they pass the official tests. (*c*) Provisions are included for guarding against exploders being rendered unsafe by unauthorised interference, and for periodical examination and efficient maintenance of approved exploders. The following apparatus has been approved by the Board of Trade under this Order:—Davis No. 15X (1932) low-tension exploder and No. 1X (1932) high-tension exploder for single shots, both manufactured by Messrs. John Davis & Son (Derby), Ltd. The Explosives in Coal Mines (Electrical Shot-Firing Apparatus) Order, 1932, may be obtained from the Stationery Office (1d. net).

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Airdrie.—Extension of municipal offices; borough surveyor.

Anderby (ALFORD, LINCS).—Hotel, with electrical work (£25,000); W. H. Bridges, architect, Sheffield.

Ashton-under-Lyne.—Mill for Whitelands Twist Spinning Co., Ltd.; William Storrs & Co., Ltd., builders, Stalybridge.

Ayr.—Premises, Sandgate, for Afflecks, Ltd.; Jas. Carrick, architect, Wellington House, 25, Wellington Square, Ayr.

Ayrshire.—Houses (32), Springside (electrical work), for the C.C.; William Reid, county architect, 14, Wellington Square, Ayr.

Beaminster (DORSET).—Houses (60); R.D.C. surveyor.

Becontree.—Church of England, Halbutt Street; Catholic Church, Goresbrook Road; and Methodist Church, Ilchester Road; church authorities.

Bedford.—Houses (210); borough surveyor.

Birmingham.—Houses (40), Lodge Farm Estate; H. H. Humphries, city engineer. Catholic Church of Our Lady of the Rosary and Little Flower, Parkfield Road, Saltley; G. Drysdale, architect, 102, Great Russell Street, W.C.1.

Blackpool.—Estate development, Staining Road, Hardhorn; T. Edsforth. Estate development, Ivy Avenue district; Rimmer & Foster. Shops, Whitegate Drive and Forest Gate; H. Whittaker.

Bristol.—Houses (600), Knowle and Bedminster Estates; city engineer. School, Fonthill Road, Southmead; C. H. White, architect, 47, College Green.

Bradford.—Building estate, Westfield Lane, Idle; W. Wells.

Burton-on-Trent.—Houses (145), Horninglow; borough surveyor.

Cakemore.—Cinema, Feldon Estate, for Housing, Ltd.; H. G. Uglow, architect.

Campbeltown.—Installation of X-ray apparatus, with oil engine and generator, at Cottage Hospital (£740).

Cardiff.—Houses (156) and 10 blocks of maisonettes, Tremprfa Estate; city engineer.

Cardigan.—Schools at rear of Tabernacle C.M. Chapel; I. Teifion Jas. Williams, architect.

Carlisle.—Houses, Old Greystone Estate (£11,295); J. Laing & Son, Ltd. Milk depôt; Architects' Department, C.W.S., Ltd.; 90, Westmorland Street, Newcastle-on-Tyne.

Castleford.—Hotel, Leeds-Pontefract main road, Whitwood, for Carter's Knottingley Brewery Co., Ltd.; Pennington, Hustler & Taylor, architects, 25, Ropergate, Pontefract.

Cheltenham.—Ice rink, shops, &c. (£50,000), Winter Garden site; J. R. Wilkins, architect.

Cheshire.—Extensions, Upton Mental Hospital, Chester, for the C.C.; F. A. Browne, county architect, The Castle, Chester.

Coventry.—Billiards hall, Lockhurst Lane, for E. O. Shanks & Sons, Ltd.; T. R. J. Meakin & Son, architects, 11, Warwick Row.

Croydon.—Houses (46) and garages, Beech Road and Oak Avenue; Markwick & Co., builders, 4, Parade, Stafford Road.

Darwen.—Houses (24), Marsh House site; borough surveyor.

Dorchester.—Houses (20) for T.C.; Mr. Box, builder, Bournemouth.

Dudley.—Reconstruction of the Hen and Chickens Inn, Castle Street and New Street; licensee.

Dundee.—Modernising St. Joseph's R.C. Schools, Blackness Road (£12,000); executive officer to the Education Authority.

Ealing.—Shops (17) and flats, North Circular Road, and houses (117), Perivale Lane; G. L. Russell, architect. Twelve shops and flats, Greenfield Road; G. Gould, architect. Hotel, Greenford Road, for Youngs Brewery, Ltd.; Clemence & Co., architects. Shops, Ruislip Road; Hamblin, Fox & Bailey, architects. Premises, Uxbridge Road, for Standard Wallpaper Co., Ltd.; Waler, Hearne & Chute, architects. Houses (32), Lynwood Road; London & Provincial Building Co., Ltd.

Eastbourne.—Flats (64), Churchdale Road; borough engineer.

Eastcote (MIDDLESEX).—Houses, Brindle Road and Deane Croft Road; Nash, Ltd., builders, Deane Estate, Field End Road.

East Ham.—Estate development, Little Ilford Lane; H. C. Horswill, Ltd. Factory, Greenhill Grove; T. Anders. Houses (50), Gainsborough Avenue; W. Goodchild & Co.

Edinburgh.—Villas, Warriston Terrace and Warriston Gardens; G. R. Black, builders, 214, Leith Walk, Leith.

Egham.—Garage repair shop and café, By-pass Road; Egham Motor Co.

Enfield.—Factory premises, Cambridge Road, for Belling & Lee, Ltd.; Commercial Structures, Ltd., builders, 38, Canal Road, N.1.

Essex.—School (£33,000), Thorpe; director of education, Chelmsford.

Faversham (KENT).—Canning factory, Alexandra Field, with electrical equipment; British Fruits, Ltd.

Folkestone.—Houses (20); borough surveyor.

Gainsborough.—Houses (50) for U.D.C.; Coggan & Dawber, Worksop.

Glasgow.—Housing scheme, Blackhill Golf Course; city engineer.

Great Yarmouth.—Primitive Methodist school; Olley & Haward, architects, 5, Queen Street.

Gunnersbury.—Leather factory, Power Road; W. Wood & Son, Ltd.

Harpenden (HERTS).—Houses (72); Workmen's Housing Association.

Hastings.—Reconstruction (second portion) White Rock baths; Parmeter & Gaston, quantity surveyors, Ipswich.

Heanor.—Houses (78), Calladine Estate; U.D.C. surveyor. Factory extensions, Ebenezer Street; A. E. Allen & Co., Langley Mill, Notts.

Hebburn-on-Tyne.—Public house for G. Conlin; J. H. Morton & Sons, architects, Fowler Street, South Shields.

Hetton-le-Hole.—Houses (100) for U.D.C.; A. H. Fennell, architect, Bridge End Chambers, Chester-le-Street.

Hollinwood.—New Church of Corpus Christi, Old Lane; H. A. Yearsley, architect, Imperial Buildings, Oxford Road, Manchester.

Houghton-le-Spring.—Houses (102), Newtown area; U.D.C. surveyor.

Hounslow.—Shops, Great West Road; John P. Blake, architect, Norvic Hibernia Road and Bank House, High Street.

Irish Free State.—(GILFORD, Co. DOWN).—School, for Down County Regional Education Committee; Castor J. Love, architect, 5, Wellington Place, Belfast.

Kendal.—Houses (111), Kirkbarrow; borough surveyor.

Lancaster.—Alterations, Storey Institute (£4,900); Lancs. E.C.

Leeds.—Church schools, Torre Estate; R.C. Diocesan trustees.

Lincoln.—Re-erection of portion of leather works, Boultham; Dawson & Son.

London.—(BATTERSEA).—Buildings, Southampton Wharf, for Garton, Sons & Co.; Brightiff & Brightiff. (ELTHAM).—Hotel (£17,500), for Messrs. Beasleys; R. M. Allen, architect. (PUTNEY).—Factory premises, Upper Richmond Road; Sampson and Hutchcroft, 188, Garratt Lane, Battersea, London, S.W.18.

Longbenton.—Houses, coastal road; Gibson Bros., builders, Hill Heads, Whitley Bay.

Maldon (ESSEX).—Telephone exchange; H.M. Office of Works, King Charles Street, S.W.1.

Manchester.—Hospital; secretary, Manchester Northern Hospital for Women and Children. Alterations and additions to hospital block, Nelson Street, Chorlton-upon-Medlock; Thomas Worthington & Sons, architects, 178, Oxford Road. Church and Sunday school, Platt Lane and Hart Road, Withington; Arthur Brocklehurst & Co., architects, Martin's Bank Buildings, 10, Norfolk Street. R.C. church; rector of St. Patrick's.

Middlesex.—Railway stations, Stanmore and Whitchurch Lane, for the Metropolitan Railway Co.; H. S. Chapman, secretary, Baker Street Station.

Motherwell.—Shops, Wishaw, for Thomas Baird & Sons (£2,000); the manager.

Newbiggin-by-the-Sea.—Houses (50) for U.D.C.; J. Kailofer, surveyor, Council Chambers.

Newcastle-on-Tyne.—School, Westgate Hill; F. H. Holford, city architect, Town Hall. Houses, shops and bakery, for Kirk and Dixon; Harrison & Ash, architects, 14, Ellison Place.

New Ferry.—Cinema, Bebington Road (£20,000), with electrical work, for Harold Platt; E. Sheridan Gray, architect, Liverpool.

Northern Ireland.—(LURGAN).—School (£16,500), for the Armagh County E.C.

North Riding.—Extensions to Morris Grange Sanatorium for C.C.; Thomas Willoughby, builder, Northallerton.

Nottinghamshire.—Schools, Parkdale, Kimberley and Sutton; county E.C.

Oldbury.—Houses, Mushroom Hall Estate (164), and Warley Hall Estate (64); U.D.C. surveyor. Ten shops, for U.D.C.; A. N. Peto, architect.

Oxford.—School extensions, Bardwell Road; A. E. Lynam.

Plymouth.—Flats (56), Vicarage Road, and rehousing, Peel Street area; city architect. Bus garage, Milehouse (£11,178); A. J. Main & Co.

Pontefract.—Church Hall, Upton; R. A. Easdale & Son, architects, Castleford.

Portsmouth.—Seven new roads, Cosham Estate; Dockyard Housing Association, Ltd. Houses (24), Chatsworth Avenue; G. & W. Mitchell. School, Portsdown (£11,688); W. J. Nightingale & Sons, Liss, Hants.

Purley (SURREY).—Shops, Brighton Road; Arthur Willcocks, architect, Old Lodge Lane.

Quarry Bank.—Houses (44), Saltwells Wood, Coppice Lane; A. Homfray, clerk to U.D.C., Council Offices, Stevens Park.

Queensbury (YORKS).—Weaving shed, with electrical work (£20,000); Fearnley, Ramsden & Co., Westcholes.

Ramsgate.—Houses (22), for T.C.; Horace Newby, Ltd., builders.

Renfrew.—Buildings, London Street; James O. Buchanan and Co., 19, Waterloo Street, Glasgow.

Salisbury.—Re-erection of premises, Castle Street, for Woodrow & Co. (Salisbury), Ltd. (£25,000).

Scarborough.—Flats, Corporation site; T. Smith.

Shaftesbury.—Houses (24); J. P. Jenkins, borough surveyor.

Sheffield.—Extension of the Sheffield Royal Hospital; secretary.

Southampton.—Reconstruction of Baptist school, Shirley; trustees.

Staffordshire.—Senior girls' school, Stafford; F. A. Hughes, director of education, Stafford.

Stansted (ESSEX).—Houses (70); R.D.C. surveyor.

Stockton-on-Tees.—Houses (20), Burford Avenue, for C. Wright.

Swinton and Pendlebury (LANCS).—School, for E.C.; director of education.

Thornhill.—Houses (28), Thornhill, for the C.C.; Dumfriesshire county surveyor, Dumfries.

Wallsend.—Works extension, off Western Road; Hood, Haggie & Son, Ltd.

Walton.—School clinic (£3,000); Surrey E.C., Kingston.

Warrington.—Reconstruction of works, Norman Street, for the Alliance Box Co., Ltd.; Wright & Hamlyn, architects, Patten Chambers, Winmarleigh Street.

Washington (Co. DURHAM).—Houses (28); U.D.C. surveyor.

Weston-super-Mare.—Ice skating rink and pavilion; David Davidson, manager for C. Waller & Co., St. James' Street.

Wolverhampton.—Foundry extensions, Bloomsbury Street; C. & B. Smith, Ltd.

Woolwich.—Church, Eltham; Bishop of Woolwich. Flats, cleared area; East Ham borough engineer.

Worksop.—Premises for Worksop Co-operative Society, Ltd.; J. Haslem & Son, architects, Ryton Chambers.